NATIONAL TECHNOLOGY EXTENSION SERVICE ACT OF 1990—H.R. 4659

HEARING

BEFORE THE

COMMITTEE ON SMALL BUSINESS
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

ON

H.R. 4659

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WASHINGTON, DC, SEPTEMBER 5, 1990

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NATIONAL TECHNOLOGY EXTENSION SERVICE ACT OF 1990—H.R. 4659

WEDNESDAY, SEPTEMBER 5, 1990

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SMALL BUSINESS,
Washington, DC.

The committee met, pursuant to call, at 10 a.m., in room 2359, Rayburn House Office Building, Hon. John LaFalce (chairman of the committee) presiding.

Chairman LAFALCE. The Small Business Committee will come to order. This morning we consider legislation to create a Technology Access Program [TAP], which is designed to bring American small business to the technological frontier, and to improve the productivity and competitiveness of American industry. This bill, H.R. 4659, proposes something which is unique in the field of technology transfer and economic development; it proposes a system which would give businesses instant and easy access to the very best technical expertise in the world. It is hard to imagine a more user-friendly system. Recognizing the potential of this bill for American economic competitiveness, the House leadership recently adopted it as a lead item in its package of high-technology initiatives.

[The bill referred to above may be found in the appendix.]

My involvement with the issue of technology and economic competitiveness extends back several years. As chairman of the House Banking Subcommittee on Economic Stabilization in the mid-1980's, I held an exhaustive series of hearings on American economic competitiveness. As a result of those hearings, I introduced two major pieces of legislation: One to create a Competitiveness Policy Council, and the second, a bill to establish an Advanced Technology Foundation which would have funded research on generic technologies and collaborative R&D, and would have created a Federal industrial extension service. I was pleased that the Competitiveness Policy Council, which will help to bring together representatives from industry, academia, and Government to identify profitable areas for Government-industry partnerships in developing new technologies and new industries, was enacted into law in the 1988 Trade Act, and has now received initial funding.

I took an interest in this subject area—technology and economic competitiveness—because I recognized that it was one in which Government policy can have a truly profound effect on the quality of life. U.S. Government policy has played a central role in some of the most important technological events in history, including development of the computer industry, the semiconductor industry, and

the commercial aircraft industry. But perhaps the most striking example is the U.S. agricultural research and extension system, which for a century has funded agricultural research and disseminated new technology to farmers. The system has generated a rate of return far higher than that of typical private investments. Indeed, it is a major reason why agricultural productivity growth has been higher over the past 50 years than in any other sector of the American economy, and why the United States has long been the undisputed world leader in agriculture.

The bill we consider today to create a Technology Access Program would replicate important features of the agricultural system on an economy-wide scale, using the latest computer and telecommunications technology. It is modeled on a Minnesota State program, Minnesota Project Outreach. It proposes what I regard as a unique form of technology transfer, unique in the degree to which it is user-friendly. Under TAP, a business in need of technical assistance does not have to call 14 people and wait 3 weeks in order to get help; it does not have to know the 10 different protocols needed to access 10 different data bases; and it does not need to hire a staff of information-retrieval experts. Technology transfer systems which operate that way—and many do—will never reach or help most of their potential customers. Under TAP, by contrast, all a business needs is access to a personal computer and a telephone in order to have the very best technical expertise in the country—indeed the world—at its fingertips. I will leave it to our witnesses to elaborate on how the system works.

Anything can be made to sound nice in theory, however; the proof is in the pudding. To test whether this form of technology transfer actually works in practice, my staff surveyed a random sample of businesses that use the Minnesota program. The results were impressive and were the motivation for my introducing this bill. The businesses reported that their payoff in increased annual profits was more than 15 times their annual cost. These numbers suggest that a national Technology Access Program could make a real difference in the competitiveness and productivity of American industry.

[Mr. LaFalce's statement may be found in the appendix.]

Chairman LAFALCE. Some members of the panel today have been leaders in the effort to promote the improvement and dissemination of technology to the small business community, Congressmen Wyden and Sisisky. I wonder if either have an opening statement they wish to make.

Mr. WYDEN. Thank you, Mr. Chairman. I want to commend you for the outstanding job you and your staff have done on this issue, one of enormous importance to small business. I am very pleased and proud to be associated with you in this effort. Mr. Chairman, the Subcommittee on Regulation of our committee, and which I chair, has been digging into this issue for 2 years now. It is disturbing to see the Federal Government's inability to get this technology treasure trove out of our Federal labs and into the hands of small business.

For example, the General Accounting Office found in 1988 that royalties on commercialization of $60 billion worth of Federal research totaled only $3 million. This is a rate of return on invest-

ment of .00005 percent. It is quite obvious to me that the Federal Government has simply got to, as an editorial in the Portland Oregonian said, get the lead out of the labs. Fifty cents of every research dollar invested in this country is spent at a Federal or federally supported lab and I think it is worth noting that politicians are constantly talking about job programs.

Here we have an opportunity to promote jobs, promote economic development and we can do this simply by making sure that we see the fruits of our research transferred from the Federal labs. I am of the view that in an increasingly competitive global economy, the question of improved technology transfer is literally the key to the competitive kingdom. I am very pleased that you are moving forward with this legislation. I think it is high time. I would also like to note, Mr. Chairman, that Dr. Allan Bromley who is the President's science adviser testified on the question of the technology transfer before our Subcommittee on Regulation last October. The President's science adviser assured us then that he understands the problems stalling commercialization and that enhanced technology transfer would be a key piece of the President's overall science policy.

But those assurances are now almost a year old and we have seen essentially nothing on paper to back up the promises of the President's science adviser. So I think that we need a process to force these changes. This legislation allows us to do this, to do it in a sensible and cost-effective way. It is a real pleasure to be able to associate myself with your efforts. Thank you for all of your support.

[Mr. Wyden's statement may be found in the appendix.]

Chairman LAFALCE. Thank you very much. Without objection, I would like to insert the opening statement of the ranking minority member immediately after my opening remarks.

[Mr. McDade's statement may be found in the appendix.]

Chairman LAFALCE. Mr. Sisisky.

Mr. SISISKY. I too congratulate you, Mr. Chairman, on this important piece of legislation. I would never attempt to stop getting the lead out of the lab of my colleague here. Thank you.

Chairman LAFALCE. We will go to the witnesses now. We have today Mr. Raymond Kammer, Deputy Director of the National Institute of Standards and Technology, Department of Commerce; Joseph Shuster, chief executive officer of Teltech, in Minneapolis, Minnesota; Leo Reddy, president, National Coalition for Advanced Manufacturing; Lloyd Anderson, director, Center For Industrial Research and Service, Iowa State University.

Gentlemen, we are delighted to have you with us today. We will put your statements in the record. You may read them or summarize them. Mr. Kammer.

TESTIMONY OF RAYMOND G. KAMMER, DEPUTY DIRECTOR, STANDARDS AND TECHNOLOGY, U.S. DEPARTMENT OF COMMERCE

Mr. KAMMER. Thank you, sir. I am Ray Kammer, Deputy Director of the National Institute of Standards and Technology. I am here to discuss the proposed legislation for improved access to tech-

nical information and expertise within the Federal Government. I think it is a well known story that compared to foreign competitors many U.S. labs have been slow to commercialize new technology.

It is not enough for the United States to be first in developing the new technology if we are unable to bring it to the commercial market. The problem of applying and commercializing new technology is complex and there are no easy solutions. Limited access to Federal technology and expertise, particularly by small and medium size businesses, is certainly part of this problem. We commend this committee's continuing efforts to improve that access.

The bill currently before us. H.R. 4659, seeks to improve the technology transfer process by providing single point, interactive access to a database of federally funded research and development activities, as well as technology transfer personnel. In my view the activities outlined in the bill present excellent tools for dissemination and access of information: It is our view that we do not need additional authorization to pursue these ideas.

In fact many of the ideas are on-going at some level under existing authorization. There are already numerous on-line databases of federally funded technology within the Department of Commerce. The Technology Administration's National Technical Information Service currently has two on-line databases of Federal research and development activities. The Federal Research In-Progress Database, available through Dialogue, provides access to information about on-going federally funded research activities in the fields of physical sciences, engineering and life sciences. The Federal Applied Technology Database allows industry access to more than 8,000 Government-owned inventions issued since 1981. The Department of Defense, NASA, and DOE also have their own on-line databases and will provide direct access to responsible personnel.

Interactive assistance with these and other existing databases is already being provided through NASA Industrial Application Centers. The Industrial Applications Centers [IAC], program was established in 1970 specifically to provide technical solutions for industry problems. NASA IAC's have access to over 500 on-line databases, including 60 to 70 Federal databases and will provide contacts with technical experts in both the Federal Government and private industry.

Small Business Development Centers are also providing single point, interactive, access to a number of information databases and Federal technology transfer agents. There is also access to expertise through Federal laboratories through the Federal lab consortium. The number of programs relative to the objectives of this legislation were also created under the Technology Competitiveness Act of 1988. Included was the Boehlert-Rockefeller Program to provide technical assistance to State technology programs throughout the United States to enable those programs to help local businesses and increase competitiveness. The program works through and with State and local outreach programs to help small and medium size businesses identify, access and apply appropriate Federal technology to their technical problems. Technology agents work through existing programs, such as the Small Business Development Centers or the NASA IAC's, and depend heavily on Federal

technology databases and other Federal technology services as the tools of technology transfer.

In addition, the Technology Competitiveness Act established within the Technology Administration the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation. Current information on Federal, State, and local programs is fragmented among providers and is difficult to access. The clearinghouse is designed to be a central resource for sharing information on State and local initiatives, programs, and experiences; and a source of analysis as to the variety and effectiveness of these various initiatives. The clearinghouse will provide a mechanism whereby Federal, State, and local Governments can work together as partners to share information and expertise to enhance the contribution that technology can make to competitiveness and economic development.

The Competitiveness Act also established the Regional Centers for the Transfer of Manufacturing Technology for the purpose of enhancing productivity and technological performance through a variety of mechanisms including technology transfer activities and information dissemination. Three centers currently exist. The centers work hands-on with small- and medium-size firms to modernize their manufacturing processes and improve competitiveness. The centers provide up-to-date, practical information and expertise, helping companies with technology adoption and implementation.

The Technology Competitiveness Act is of course just one of many pieces of recent legislation directed toward technology transfer and industry assistance. The Bayh-Dole Patent and Trademark Amendments of 1980 was one of the first laws passed in the effort to improve technology transfer. Also, in 1980 Congress enacted the Stevenson-Wydler Technology Innovation Act which made Federal technology transfer the responsibility of each Federal laboratory. It provided the authorization for the Technology Administration's Center for the Utilization of Federal Technology which currently operates the NTIS Federal technology database. The Stevenson-Wydler Act was amended by the Federal Technology Transfer Act of 1986 to further improve the technology transfer process. The Federal Technology Transfer Act also formally established the Federal Laboratory Consortium for Technology Transfer to promote rapid movement of Federal laboratory research results and technologies into the mainstream of the U.S. economy.

Most recently, Congress authorized funding for the National Technology Transfer Center to be established in Wheeling, West Virginia. This center is to serve as a national focal point for accessing Federal resources and hopes to act as a catalyst for accelerating private sector utilization of Federal technology. The center is to compliment existing Federal technology transfer services, including IAC's, Federal laboratory consortium, and the small business development centers. The primary focus on technology access will be supported by outreach and network development activities directed toward increasing private sector awareness and use of technology transfer resources nationwide. In conclusion, I think it is important to reiterate that the proposed legislation, H.R. 4659, is technically sound and the activities described are important tools for technology transfer and industry assistance. However, new legislation for

these activities is not necessary. Authority for these activities is included in the Technology Competitiveness Act as well as other technology transfer legislation, as indicated earlier in my testimony.

Furthermore, and perhaps more importantly, most of this activity already exists at some level either in the Government or the private sectors. It is important in this period of fiscal austerity that we not spend time and money reinventing the wheel. We must be careful to coordinate our existing resources and ensure that our efforts are not so fragmented that no program is able to operate effectively. Yes; the ideas presented in this bill are important to American industry, but we must recognize that these goals can be achieved under existing programs.

[Mr. Kammer's statement may be found in the appendix.]

Chairman LAFALCE. Thank you.

TESTIMONY OF JOSEPH SHUSTER, CHIEF EXECUTIVE OFFICER, TELTECH INC.

Chairman LAFALCE. Our next witness will be Mr. Shuster.

Mr. SHUSTER. Thank you for inviting me to be with you and to share our experiences in providing a national technology transfer service. I think you will come to agree that what we have learned has a great deal of relevance to your deliberations on House bill 4659.

Smart, world-class competitors are constantly looking for leverage, and nothing today provides more economic leverage than technical knowledge—nothing.

If publicly-funded American research produces the most—and often best—technology in the world, why aren't American companies doing more to exploit such know-how for competitive advantage? The answer is simple. They haven't had, and most still don't have, convenient access to this knowledge. That is particularly true of small companies. Until Teltech created a convenient infrastructure and began providing its service, it was almost impossible for companies to efficiently and reliably access needed outside technology.

Many believe that Japan's economic miracle happened because they excel in commercializing research. This is partially true, but I believe that their greatest genius is in finding relevant technologies in the first place. They do this systematically on a world-wide basis. They clearly understand that access to research is as good as doing the research—and one heck of a lot cheaper.

By comparison most American companies, and particularly small ones, don't have access to any organized technical information system. Many have never heard of a technical database. A large number don't even know where our major national laboratories are located—much less what is going on inside them. To expect these companies to remain technically competitive over time would be laughable, if it weren't so sad.

The service described in House bill 4659 is a kind of one-stop technology shopping center in tune with modern industry's technology needs. This bill will give American small businesses access to the best technology in the country on a day-to-day, grass roots

basis. For the first time in history, rural and small companies will have the same access to information and technical knowledge as the Nation's largest corporations.

The proposed service elements include: One, access to technology through new and existing databases to virtually all of the world's technical literature; two, access to Federal and other technical experts; three, access to needed marketing and competitive information through existing databases; four, access to other Federal and State services.

The bill anticipates the use of most of the Federal databases that have already been created. Many would be usable in their present form while others would require some modifications. The bill also calls for a standard format and front-end software that would properly integrate all the databases for ease of use.

The cornerstone of the program, however, will not be data bases, but rather, human beings—immediate and direct access to experts able to respond to virtually any technical question whatsoever. Implicit in this day-to-day interaction is closer bonding between academic and Federal experts and their industrial counterparts.

It is appropriate that the bill proposes to offer the service free or on a cost sharing bases to companies with annual sales of less than $15 million. Small businesses create the most jobs. They are also more risk oriented, faster moving and, because of internal resource limitations, stand to benefit most from reaching outside for help. Ironically, while they have the greatest need for the kind of services called for in this legislation, they are also least able to pay. They are much more prone to the problem of not knowing what they don't know.

Conversely, many large- and medium-sized companies across the Nation are already reaping the competitive advantages of technical outreach. They subscribe to Teltech. Nowhere are their satisfaction levels, value perceptions, and consequent willingness to pay for such services more evident than in the remarkable fact that each year 92 percent of them resubscribe. As for the anticipated impact of this legislation, a variety of studies have documented the remarkable payback associated with technology transfer.

DOD and DOE did a study showing a benefit cost ratio of 26 to 1, Pennsylvania State did a study showing 17 to 1 pay back. The Federal survey showed a 15 to 1 pay back. Teltech user study showed 23 to 1 and Bell Laboratories showed a 14 to 1. This data is almost too spectacular to be believed. However, those of us who are in the technology transfer business can easily understand how effective use of technical information resources can literally spell the difference between business success or failure. Incidentally, the chart shows only primary benefit. The secondary benefit of using new knowledge as a building block can also be dramatic.

My personal experience demonstrates the point. I started a company, MVE Cryogenics, in 1963, and I can tell you that one piece of timely assistance from a university professor saved our corporate life. Today, MVE is the world leader in its field, and employs well over 1,000 people. Long-term benefit in this case is obviously very great but also difficult to quantify.

From industry's perspective, there is no doubt that it is generally more important and useful to systematically transfer the knowl-

edge, know-how, and technical insight learned in our many research labs that it is to transfer a piece of intellectual property once in a while.

This bill is sensitive to everything Teltech has learned in providing a technology transfer service to a nationwide client base. For instance we learned that: One, to qualify as adequate, a technology transfer system must provide for day-to-day interaction between the providers and the recipients at the grass roots level. That is where the action is—where technical decisions are made, not one of the whole litany of services mentioned by Mr. Kammer does this.

Number two, the service must be complete. There should be virtually no gaps in its technical coverage, not one of the litany of services mentioned by Mr. Kammer is this complete. The service must be accessible right from the desk of each end user. Not one of the services mentioned by Mr. Kammer makes this possible.

Three, effective use of a technology transfer system requires a great deal of training. Regardless of the potential benefits, U.S. industry, in many ways, is a reluctant partner, no matter what it says to the contrary. The process is definitely counter cultural. Americans have always essentially turned inward when confronted with a technical problem or need.

The good news is that once a company—large or small—is given access to a technical outreach program that is truly in-tune with its needs and sensitivities, it will take to the program with a vengeance.

It is good for us to recognize that, when it comes to technology, we are still the richest Nation on Earth. But we must also shoulder the critical responsibility of ensuring that this wealth is effectively shared. American companies and their scientists and engineers can no longer afford to work in corporate isolation, wrestling with problems that have been solved many times before. Or worse yet, making mistakes that others have made before them. Neither can we continue to justify today's myriad of underfunded, incomplete, and splintered State and Federal technology transfer programs that practically nobody uses and that seem to say, come to me if you can find me, and I'll try to help you if I can. There is no doubt that the infrastructure described in the bill would pull many of these programs together, and substantially enhance their usefulness. Mr. Kammer said they are already mandated to accomplish what is described in this bill. So are other agencies and State programs mandated. While all of these programs do some good, they are simply not getting the job done for small business.

It seems to me that given their mandate the NIST would jump at the chance to encourage a bill that would tie the myriad of splintered, incomplete services into one single integrated program that is already tested and proved. I think Mr. Kammer would concede that with all the cited technology programs in existence, small businesses still find it virtually impossible to find the technical help they need.

We always need more research into new technology but we don't need new research as much as we need better utilization of the technology we already have. The truth is that Japan greatly outleverages the United States largely because of its passionate dedication to seeking out ways of accessing and disseminating technolo-

gy. We, on the other hand, focus almost entirely on technology production, with practically no facility for sharing or extending what we produce.

Some concepts that make a big difference are simple, but eloquent in their simplicity. In aggressively reaching out for information that is available to everyone, Japan is merely acting on its recognition of a simple idea. They know that while basic research returns $2 for every $1 invested in a 6- to 7-year timeframe, technology transfer pays back 20 to 1 plus, and the pay-off can often be measured in days. Over the past 6 years, Teltech has been a frontline witness to the dawn of this same realization within American industry. I believe the technology transfer program called for in House bill 4659 can go a long way in restoring our formidability as a competitor on the global playing field. Where else could we find such leverage? I think no where I would bet my life on it. I have absolutely no doubt that the passage and implementation of this bill will one day be considered a milestone in the continuing economic development of this country. Thank you.

[Mr. Shuster's statement may be found in the appendix.]

Chairman LAFALCE. I take it your are an enthusiastic proponent of this bill. Thank you, Mr. Shuster. I like your testimony a lot more than I do Mr. Kammer's. Actually if he could, he would have given testimony almost as enthusiastic as yours. He had constraints on him. We all know that.

Mr. Reddy.

TESTIMONY OF LEO REDDY, PRESIDENT, NATIONAL COALITION FOR ADVANCED MANUFACTURING

Mr. REDDY. Thank you, Mr. Chairman. I am privileged to have this opportunity to appear before your committee to comment on the technology access program envisaged in House bill 4659. I would like to congratulate you, Mr. Chairman, as well as Congressmen Boehlert, Broomfield, and Wyden, for introducing this bill. It represents a creative, innovative, and cost-effective approach to diffusing technology rapidly into the Nation's industrial base. Mr. Chairman, in your letter of invitation you asked me to address the relevance of this bill for the Nation's economic competitiveness and suggest possible modifications of the legislation. I will be happy to do that.

I am speaking as president of the National Coalition for Advanced Manufacturing. This coalition, which started a little over a year ago, is rapidly growing nationwide organization including small, medium, and large manufacturers; centers of manufacturing education and research, extension, and training; national trade associations; and many others who believe that the rapid modernization of our industrial base is an urgent national issue. It is also a bipartisan nonprofit organization.

The Federal research establishment has enormous potential for assisting the Nation to become more competitive in the global marketplace. I think we all share the frustration of Congressman Wyden over the difficulties of getting that warehouse full of knowledge translated into something useful for our National economy.

Today, for example, the Federal Government is funding research on a whole range of technologies which are immediately relevant to accelerating progress in manufacturing and industry such as concurrent engineering, materials-working lasers, artificial intelligence, robotics, technical data exchange systems, et cetera. These are generic, precompetitive technologies with the most profound effect on American industry. These technologies define the very means of production. They are an integral part of the product and process technologies which combine to manufacture literally everything made by industry. These technologies are the essential tools to achieve the levels of precision, quality, flexibility, and accelerated product design cycle needed to be competitive.

If I might, Mr. Chairman, let me give you a few recent examples of the profound impact of these technologies. At its Paging Products Division in Boynton Beach, Florida, an advanced computer-integrated manufacturing facility, Motorola introduced computerized communications networks which enabled the plant to build new Bravo Pagers to customer order within 2 hours of receiving the order from corporate headquarters in Schaumberg, Illinois. This capability has enabled Motorola to beat the competition, even in Japan, for this product.

Using vision-aided robots in its Lewisville, Texas, plant, to construct microwave boards, Texas Instruments has reported a 20 to 1—2,000 percent—gain in productivity.

These examples apply as well to small manufacturers. For example, Creative Forming, Inc., of Ripon, Wisconsin, a firm with 120 employees producing plastic containers, introduced three advanced manufacturing technologies in the mid-1980s: computer-aided design, manufacturing resource planning, and statistical quality control. In 4 years, this small, make-to-order facility tripled its sales to $15 million.

If these kinds of technologies could be transferred more rapidly to American industry as a whole, the results in terms of economic strength and growth would be dramatic. Nonetheless, the United States is falling well behind its leading international competitors in the adoption of advanced manufacturing technologies. This is particularly the case with the Nation's small and medium-sized manufacturers. Their adoption rate of advanced manufacturing technologies is truly alarming. I have included in my prepared statement on page 6 a condensation of a table recently produced by the Bureau of the Census indicating the rates at which firms of different employee size are adopting advanced manufacturing technologies.

If I can generalize, what these tables indicate, in a general sense, is that smaller firms are adopting these technologies at a rate of one-third to one-twentieth of the rates used by the largest manufacturers. As you know, this is a problem not just for the small firms, but for the national economy as a whole; given the vast importance to our economy of the some 350,000 smaller manufacturers with fewer than 500 employees.

If our Nation wishes to obtain a strong industrial base able to meet the requirements both of global competitiveness and national security, it must move to arrest the erosion of the position of our smaller manufacturers. Among other things, this means creating

an environment in which these firms can gain more rapid and efficient access to the latest technological developments, especially advanced manufacturing technologies.

Given these factors, one of the most compelling arguments for the technology access program envisioned in your bill is that it is uniquely tailored to meet the needs of the small manufacturer by making the whole universe of technology available to him at or near his place of work, in a readily accessible format, on a continuing basis and at little or no cost. I noted Mr. Kammer's mention of Federal technology programs. I think that some of the statements I have just made about the slow rates at which smaller companies are adopting advanced technologies indicates that this technology is simply not getting through to the smaller companies.

I think that there is a very strong argument indeed for taking a hard look at seeing if a new database system can be created which integrates not only Federal programs but existing commercial technologies and also international databases. The experience of Teltech and other firms indicates this can be done.

So, in terms of the two sides of the argument I tilt clearly, and I think we all tilt clearly, toward Mr. Shuster's view of this. My principal reservation about this bill is that it is too modest in its pretensions. This committee, the Congress, and the Nation are deeply concerned over the relative decline of America's industrial competitiveness. The fact that the public ranks only one American car in the top 10 in terms of reliability and quality is a further indication that those concerns are justified.

To correct this situation, the Nation needs bold programs which can have an early impact and which reach all corners of American industry. The Technology Access Program which your bill would establish foresees the completion of a five-State model by fiscal year 1995. To have a national impact and to make a significant dent in the problems of American economic competitiveness and standard of living, this program should be broadened and strengthened.

For example, I would suggest the following changes in the bill as drafted. First, I would expand the number of States participating in the pilot program from 5 to 15. This would provide a much stronger foundation for moving more rapidly to a full national program, assuming that the pilot program proves successful. A larger number of participants would also permit organizing the pilot by three to four regions. A regional approach to these issues has usually proved more effective. Regions tend to have economic structures and industries with distinctive characteristics and are often organized to work together on economic development issues.

Second, I would amplify the number of public access points for this technology by not confining it only to Small Business Development Centers. Without in anyway detracting from the key role of those centers, the bill might give the Secretary of Commerce the authority to designate other centers as participants in the program. In addition to the Small Business Development Centers, there are also well-established extension service programs organized by some State Governments, by community colleges, by tech centers, and State universities. The Secretary would need to establish criteria for their participation. For example, they should have

an established program for industrial extension, well-defined mechanisms for communicating and coordinating with industry in their area, including with small manufacturers, a well-qualified staff for this purpose, and an ability to offer matching funds. Inclusion of these additional centers would also amplify the number of public access points and make the entire program that much more accessible to small business.

Third, I would increase the funding for this program at least three fold and State specifically that, if the pilot program succeeds, a substantial expansion of this program on a national scale is envisaged. I can assure you that the members of the National Coalition for Advanced Manufacturing will stand squarely behind an effort to secure more adequate funds.

Finally, I would accelerate the timetable for this program. Systems for identifying experts in various fields of technology already exist and have proven their effectiveness in several States. H.R. 4659 stipulates that the pilot program will last until fiscal year 1995, with the first evaluation by the Secretary of Commerce taking place after 3 years. Given the fact that the Technology Access Program would be building upon established systems and would not be starting from scratch, this schedule could safely be reduced by one year.

Mr. Chairman, the Technology Access Program proposed by H.R. 4659 represents a remarkable opportunity. If implemented on a national scale, this program would help reach that heretofore elusive goal: effective, timely transfer of technology from the Federal establishment into the private sector. It would use the leverage of modern data collection and dissemination technology to make the knowledge of the Nation's leading experts in any given technical field immediately available where it is most needed: In the hands of the plant engineer.

The benefits of this program far outweigh the cost. Indeed, the most compelling argument for this approach is the extraordinarily high return on investment. It is hard to imagine any program which could more directly and promptly improve industrial productivity, growth, and competitiveness than this one.

[Mr. Reddy's statement may be found in the appendix.]

Chairman LAFALCE. Thank you very much, Mr. Reddy.

Mr. Anderson.

TESTIMONY OF LLOYD E. ANDERSON, INTERIM DIRECTOR, CENTER FOR INDUSTRIAL RESEARCH AND SERVICE, IOWA STATE UNIVERSITY OF SCIENCE AND TECNOLOGY

Chairman LAFALCE. Our next and final witness will be Mr. Lloyd Anderson, director, Center for Industrial Research and Service, Iowa State University of Science and Technology.

Mr. ANDERSON. Thank you, Mr. Chairman. The center is an industrial extension service funded by the State of Iowa. Its purpose is to provide technical and management assistance to Iowa manufacturers. Since its establishment in 1963, the center has responded to nearly 30,000 requests from Iowa manufacturing firms.

The center provides these types of assistance: Problem solving in technical and management areas, relying heavily on faculty and

other university resources for assistance; decision support by assisting firms with business plans, expansion plans, product development, equipment and process selection; technology transfer through linkages with faculty, researchers, NASA, Federal Laboratory Consortium and data base searches; information dissemination and exchange through interactive contacts with manufacturers and a quarterly newsletter that is mailed to manufacturing owners and managers; continuing education through the development of workshops and conferences.

Center personnel include a field staff of six who maintain daily contact with manufacturers through on-site visits, a central staff of 6.5 persons who function as specialists in engineering, marketing, and management, and three administrative support personnel.

I was asked to comment on the importance of technology transfer to small business, the strength of Teltech's form of technology transfer and finally how the bill might be improved.

Concerning the importance of technology transfer to small manufacturers, I would like to comment with respect to Iowa. Manufacturing in Iowa is the most important source of personal income—generating nearly three times as much as farming. Contrary to common perception, more than 70 percent of Iowa manufacturing employment is not related to agriculture. Given this degree of dependence, it is essential that Iowa manufacturers must become world class order in order to compete both domestically and internationally.

In order to compete successfully, awareness of new and existing technology, technical expertise, marketing information, and management techniques is critical. Of the estimated 4,100 manufacturing firms in Iowa, more than 3,100 employ less than 100 persons. Therefore, they do not have large internal staffs of specialists to draw on. In addition, many of these firms are located in rural areas where the opportunity for peer interaction is limited.

Our experience with computerized data base searches stems from our designation as a NASA Industrial Application Center. Since our participation began, we have conducted more than 700 searches for manufacturing clients. These include searches for highly specific technical information, marketing information, preliminary trademark and patent searches. User evaluations indicate this service has been highly beneficial.

We believe electronic access to expertise and technical information is an essential tool for a modern technical or industrial extension service. As stated previously, this method of delivery is particularly beneficial for small and medium manufacturers.

I would like to relate one experience in one small company. A firm located in a small community that manufacturers waste recycling trailers has made several requests for CIRAS assistance. Verl Anders, a CIRAS field staff member for northeast Iowa, assisted the firm with a preliminary patent data base search. Several months later, the company president provided comments about the search:

> Our firm was able to enhance our relations with a major customer because of added expertise. We avoided costs in chasing ideas already patented. We can now check information previously unavailable to small companies such as ours. This makes us much more professional and competitive. Mr. Anders did an excellent job

in every respect, and the service he provided exceeded my expectations. CIRAS made a small Iowa manufacturer look good to a major out-of-State customer because we had current information available promptly. This helped us maintain contracts worth over $500,000 annually.

I have included several other examples in attachment II.

With respect to Teltech's method of technology transfer we think their capabilities represent an advance in the use of data bases to efficiently match the needs of users with appropriate expertise and information. Teltech's strengths include access to experts, as well as to technical literature, expanded data bases and an effort to make the system more user friendly. As Mr. Shuster pointed out, there are a lot of programs, small and fragmented. This is making it difficult for a center such as ours to be aware of all of them.

These are our suggestions, that in our opinion, would improve the bill. H.R. 4659 would be strengthened if the existing data base program could be consolidated into a single Federal effort. NASA experience could be very valuable to a new and enhanced technical extension program.

We suggest that existing State industrial extension programs that are not a part of the Small Business Development Center program be allowed to apply for grants to be used to increase access of small manufacturers to on-line data bases. This would be similar to the provisions regarding the Small Business Development Center Technical Assistance Program.

Finally, we believe that the time is proper to establish a permanent Federal/State Cooperative Technical or Industrial Extension Service. Need for a Federal/State Cooperative Technical/Industrial Extension Service. Within the last 12 months, three studies have been published which examined in-depth existing Federal, State and European industrial/technical extension efforts. The studies were performed for the National Governors Association, the Economic Policy Institute and the Economic Development Administration. A brief summary of each of the studies is included in attachment II.

The studies of Federal and State programs indicated that the existing industrial/technical extension services have generated substantial economic benefits, but their effectiveness is hampered by lack of funding. Because the studies have already profiled successful industrial/technical extension models, we do not believe it is necessary to embark on yet another pilot study.

There is a vital need for an adequately funded industrial/technical extension service. As indicated earlier, small manufacturers must become world class to survive. Product life cycles are shrinking, manufacturing processes and methods are undergoing rapid change and international competition is intensifying. European and Pacific rim nations are making major commitments in assisting their small- and medium-sized manufacturers. Without a similar commitment, our small- and medium-sized manufacturers will be at a serious disadvantage.

Each of the studies emphasized the need for ongoing interactive contact with manufacturers on their premises as a key factor in successful industrial/technical extension services. This has certainly been our experience. Whereas electronic access to data bases is an increasingly important tool in technology transfer, professional

assistance is required to help clients identify problems and needs, formulate inquiries, and finally, to assist clients in acting on the information that is provided.

It is our belief that a Federal/State Cooperative Industrial/Technical Extension Service should be established in order to substantially increase our industrial outreach capabilities, that it be permanently funded and that emphasis be placed on assisting existing small and medium-sized manufacturers. Thank you, Mr. Chairman.

[Mr. Anderson's statement may be found in the appendix.]

Chairman LAFALCE. Thank you, Mr. Anderson. We thank all the members of the panel. I will defer my questioning until after the other members of the committee have had an opportunity to ask their questions. Our first questioner is Congressman Wyden.

Mr. WYDEN. Thank you very much, Mr. Chairman. Mr. Kammer, let me start with you since you represented the administration today. Dr. Bromley testified almost a year ago, describing the process in his words as one filled with Byzantine complexities. Can you cite me specific steps that the administration has taken in the last year to reduce the Byzantine complexities Dr. Bromley referred to?

Mr. KAMMER. I can cite a number of examples where I think the objectives have been advanced but the complexities increased, not decreased, I would say, in the last year. Part of my reservations about the bill that I presented is that it seems to add another idea to the process without simplifying the process.

Mr. WYDEN. What has the administration done in the last year? Dr. Bromley promised my Subcommittee on Regulation a plan for reducing the complexities, yet, we still have nothing on paper. That is one of the reasons we need this bill and I think Chairman LaFalce's legislation is so important.

Name me one specific step in the last year that the administration has taken to do what my constituents in Oregon, in the newspapers, and in letters to my office call getting the lead out.

Mr. KAMMER. I think the implementation of the Boehlert-Rockefeller program and the information technology centers in the last year have been useful steps.

Mr. WYDEN. I identified five separate roadblocks in technology transfer here with Dr. Bromley. First, that the labs did not have technology transfer officers; second, that they did not have the legal staff to help process legal concerns; third, that the DOE labs did not promptly issue security clearances; four, that there was not a clearinghouse to address these issues; and the fifth roadblock was that it was not even a priority for the managers. Has anything been done on those five roadblocks?

Mr. KAMMER. With respect to the clearinghouse, as you probably know, one was mandated by the Competitiveness Act of 1988. It has been set up now. It is just beginning operation but it is funded. That is in the Technology Administration. The head of that is Rob Atkinson. His phone number is 202-377-8100.

Mr. WYDEN. Let me ask Mr. Shuster. Mr. Shuster, are your people aware of a clearinghouse being in place where they can now go to get what we envisage and what you in Minnesota have been talking about, this one-stop service?

Mr. SHUSTER. Frankly, we are confused. We hear the word, clearinghouse. We don't even know what it means.

Mr. WYDEN I would like to see some specific actions taken on these roadblocks. I don't know of any. Mr. Shuster and Mr. Reddy run these programs. Mr. Shuster says he doesn't know what clearinghouse means. Mr. Shuster do your people as of today have access to a clearinghouse that will cut through the red tape that we heard about at the earlier hearings?

Mr. SHUSTER. No.

Mr. WYDEN. Mr. Reddy, do your people have access to a clearinghouse that cuts through the red tape we identified at the earlier hearing?

Mr. REDDY. Certainly not. I just received yesterday publications from the clearinghouse to which you refer. They are very small directories which may be useful to some people. To the manager on the factory floor, however, these are practically useless. They don't contain the data bases direct access to experts which your bill would permit to happen.

Mr. WYDEN. Let me ask you gentlemen just one other question. I know my colleagues have questions. The administration says that our proposal would duplicate good working programs that are already in place.

Mr. Shuster, Mr. Reddy, are there any good working programs that are now in place that would duplicate what we are doing? I mean, your people are on the front lines trying to cut through this muscle-bound structure that is hampering commercialization. Are there any good programs that you know of that would duplicate something useful now being done, Mr. Shuster?

Mr. SHUSTER. Yes; I think there are some very good programs out there, and the bill proposed here would just make them all work better and help companies get access to them. There are some magnificent programs out there, some great data bases, but companies just don't have the facility to access them, and that is what this bill addresses.

Mr. WYDEN. Mr. Reddy?

Mr. REDDY. Congressman Wyden, I would answer this question in the following way, that, yes, there are numerous programs out there, many of them are excellent programs. I would say at the same time that I see the technology access program not as a substitute for those programs, but providing something which does not currently exist. It is more than a niche. There is a gap and I think it would fill a gap.

I know of no program which makes immediately available to engineers and managers on the factory floor a data base which gives them instant access to the country's leading experts and the problems that they have.

Mr. WYDEN. That is helpful because that is the key question. One last question if I could for you, Mr. Kammer. As of today, have the labs designated a full time technology transfer officer?

Mr. KAMMER. Some have. Ours has, and has for a number of years, as was required under Stevenson-Wydler. Many laboratories do not have full time people. They have part time people, and I don't have the numbers at my command, but certainly not all labs have.

Mr. WYDEN. It is over half; is it not? How can we say we have a technology transfer policy in this country when over half of the

labs haven't even designated somebody who is specifically in charge of shepherding these questions.

Mr. KAMMER. There has been progress on that front in the last year. The Secretary of Commerce and the Secretary of DOE have met a number of times and DOE has now made a commitment to do exactly that, as well as to simplify a number of their access procedures, including security, and DOE is a substantial part of the $65 billion effort in the United States.

Mr. WYDEN. I just have to tell you, and I hope you will tell Dr. Bromley, that I was very encouraged when he testified because I thought he came up here and he acknowledged the problem. He told us a year ago that there are real problems. But as far as I can tell in the last year, it has basically been business as usual. There has been very little real change. But I just hope the administration will stop the foot dragging. We are spending $60 billion a year in these labs, half of our Nation's total research funds go into these Federal facilities, and I think it is unconscionable that we are not getting the fruits of our federally funded research out, and if we don't, the Western Europeans and the Japanese will.

Congressman LaFalce has done great work in terms of Europe 1992. We can be sure that the Europeans are going to be able to exploit the fact that we aren't getting the research out of our labs. We just cannot afford this dawdling and dilly-dallying.

Mr. Reddy said specifically there is nothing that his managers can use. I will have some questions on second round, Mr. Chairman. But the reason we need your aggressive legislation is because the administration in the last year has done very, very little to turn this around.

Chairman LAFALCE. Thank you very much, Mr. Wyden.

Mr. Sisisky?

Mr. SISISKY. Thank you, Mr. Chairman. I appreciate the testimony of all of you. Mr. Kammer, I am not going to pick on you now. I don't mean to do so. I would like for you to defend yourself. You made a statement that we recognize these goals can be achieved under existing programs, and the next speaker, Mr. Shuster, on page 4 of his testimony outlined four or five things and said you are not doing them. Would you like to defend yourself now? You heard the testimony, of course, and I think you should have time to rebut.

Mr. KAMMER. The question I think that remains for us all to answer, and it is almost a reproach to ask the question as with some programs already established with roughly the same intention, certainly the same general objective, why is there a belief that creating one more will somehow resolve the problem? It might be better to focus on what we currently have in place and try and manage it more intelligently.

There is about a half billion dollars spent on technology transfer in the States, for instance, and one of the concepts that one would like to be able to reach for and it is a difficult one, it would require a lot of organization, is to try and relate all of the State efforts to the Federal effort. I would say the Federal effort needs to support the State effort, many of the States actually lead the Federal Government. Certainly they have been more experimental and aggressive.

Mr. SISISKY. Of course, it is a good thing that you posed that, because Congress can pass all the laws they want, or authorize all the things they want, but unless the administration carries those things forth, and I mean with the intent of making sure what is in place is put into effect, it really doesn't make any difference if another program is established, you are right.

Mr. KAMMER. I certainly didn't mean to presume to imply that that intention was the explanation. It is a very difficult problem. It is not only conceptually difficult, but even if you were absolutely certain you have the right idea, there are an awfully large number of people that have to be persuaded that you have the right idea.

Mr. SISISKY. We have a golden opportunity now, some of the great national assets I think in this country really are some of our national labs. I have been dealing with the laboratories particularly in the Department of Defense and DOE, like the Lawrence Livermore and the Sandia, whose workload is shrinking.

The development of nuclear weapons is not as pronounced as it was. We have been trying to do something with that. Last year we passed a law to allow them to go outside of the perimeters of the Department of Energy and the Department of Defense to take contracts, because it would be the worst thing that could happen to this Nation to shrink those national assets that we have.

Now, having said that and somebody just briefly mentioned security, how do we keep the technology transfer out of the hands of foreign Governments? They could own totally a small company of 100 employees. How do we insure against this happening?

Mr. KAMMER. Sir, if you can come up with an answer to that, it would certainly make my life a lot simpler and quite a few other people's. Our society has set a group of rules that it is going to comport itself by and it includes free access to information for all. We haven't in a society been at all comfortable with the idea of discriminating among people by citizenship, for instance. That has a substantial advantage to people from other countries, and you have even seen some of them exploited very effectively.

Mr. SISISKY. Absolutely. Anybody else care to comment?

Mr. SHUSTER. I think one way we can help the situation is give our companies equal access to the same information. The Japanese are much better organized to access our own information than we are and I think that is the tragedy.

One of the reasons I think that the program that has been proposed in this bill is very different is the system works. It has been working every day for the last 4 or 5 years. It has been proved. It has been tested. Our company right now helps some company every 1½ minutes of every hour of every day through some technical problem—often critical path problems. It surprises me that the Government won't take advantage of all we have learned. All present programs lack the necessary process which is the essence of the present bill.

The potential benefits are well known. Even if the benefits weren't so well quantified, one should be able to appreciate the benefits intuitively. If you, Congressman, were a young engineer getting out of school and we gave you access right at your desk to all the technical literature that you need in your job, and we also gave you 10,000 experts to act as your personal assistants through

your entire career, would you be better? I think until this country provides this kind of technical assistance at the desk of every technical professional in this country, we just haven't done the job as well as it should be done.

Mr. SISISKY. Does that include the shared computer-aided design? I think you mentioned that, Mr. Reddy. In fact, I had a hearing on that, Mr. Chairman, last year. It is a growing type of thing. There are some legalistic problems in there, too, I believe; is it not, are there shared computer-aided design?

Mr. SHUSTER. Are you asking me?

Mr. SISISKY. I don't know who had mentioned that before.

Mr. REDDY. I mentioned that. I think you are mentioning two things. One is the use of computer-aided design which is perhaps part of a larger technology known as computer integrated manufacturing, which is having a very profound effect on our manufacturing efficiency. There is the related concept of sharing, which gets into antitrust provisions and that sort of thing. Congressman Wyden is very familiar with that. That is an interesting question in its own right, and a somewhat countercultural one as to whether you can get small companies to share and so forth.

But I would like to add another comment about the importance of this particular program and emphasizing the delivery of this technology directly on the factory floor.

Mr. Sisisky, I have been traveling around this country for the last several months talking to businessmen and manufacturers from corporations of all sizes, and one of the main subjects that comes up is this whole question about Federal R&D, and why can't this be made available, why can't more Federal R&D spending be devoted to technologies which directly help our economic strength, and I must say one theme I get back all the time, well, two themes that I keep hearing.

First is that supporting research and advanced technologies is extremely important, but it is even more important, far more important is to transfer existing on-shelf technologies. We have a huge storehouse of technologies readily available, and getting it into the hands of the manufacturer, particularly the smaller manufacturer, is a tremendous challenge.

The second point is that most of the research of the Federal Government in this area is considered to be, viewed as largely irrelevant. Even the work, frankly, at universities is largely irrelevant, unless you can bring that technology directly into the plant of the man who is managing a factory operation. Unless you make that relevant to his particular day-to-day needs, forget it. He is just not particularly interested. Doing that is a very difficult thing.

I think the genius, frankly, behind our program that you are using is that it uses advanced technology. It is for integrating and unifying data base systems, tying them in with the experts, relating them to particular problems that people deal with, so that the engineering manager can immediately locate the leading experts in the country, leading in the world, and the specific problem that he is facing in his specific plant situation. I think that is a very powerful program and one which does not exist to that degree to my knowledge anywhere.

Mr. SISISKY. Thank you.

Chairman LAFALCE. Mr. Lancaster?

Mr. LANCASTER. Thank you, Mr. Chairman, for these hearings and for this legislation. I grew up on a farm and can speak with very personal knowledge of the important role that the extension service played in my family's success and in the success of many farm families across the country, and feel that the application of that concept to small business are sharing in the research efforts going on around the country is a very good one and I am happy to be a cosponsor of this legislation.

North Carolina is blessed with very rich resources in research. They are premier universities and the research triangle which is formed in the center of those three great research universities.

To carry forward just a little bit farther on one of Mr. Sisisky's questions, I think perhaps the question was not fully understood, because I think what he was getting at is not the sharing of nondefense research with foreign countries, but the concern about sharing research that might have security implications. Mr. Shuster, in your answer you seem to say that the answer to this is for us to get their research and for them to get ours.

But I wonder if you would, one or more of you would comment on the transfer of technology that might have security implications, and how we can prevent that, because, of course, that has been a problem with larger companies and surely would be with smaller companies.

Mr. REDDY. I would be happy to comment on at least one aspect of that, sir. This problem, of course, has been coming to the fore in light of developments over the last year or so in the international situation, and one of the things that the national laboratories are beginning to do is to reorganize their research under defense unique and nondefense unique headings. I know that Los Alamos and Lawrence Livermore are doing that to try to address that problem. There will also be some defense technologies which will also be unique, but I think there is a realization that there is a growing field of technologies which have been considered to be security classifications, which can be taken out of that category. At least the process of categorization is currently going on. But that addresses your question.

Mr. SHUSTER. Mr. Lancaster, I think that is a separate problem, the transfer of classified information. The people that have this sensitive information are, it seems to me, responsible for that. We have in our particular service a mechanism for both the client and the expert to preserve their proprietary interests. It is a different problem that needs to be addressed.

Mr. LANCASTER. But the problem with the Mitsubishi—I think it was the Mitsubishi transfer which has resulted in the Soviet Union being able to produce a much quieter submarine, is what concerns me. Are there other technologies which certainly have a very rich and profitable application in nondefense areas, but also have defense implications, and if there are, then how do we prevent that happening again in this particular legislation, which is going to open up and make available for industrial application the research that is going on at our labs?

Mr. SHUSTER. I would just like to relate—I don't know if it is totally relevant—a personal experience. We build equipment, low

temperature equipment which was on the positive list and considered strategic to the enemy. The specific product was a very unique liquid helium transfer line.

Over a period of time, a Japanese company visited our company with the promise of a contract for which we would have had to get the import certificate and an export license.

Over a period of time, they lifted all the technology and did it themselves. They stole it. I am not so sure that we can easily legislate that problem to go away. The legislation proposed in this bill would not have any effect on the transfer of that kind of information. It would not prevent or encourage the transfer of classified information or knowledge.

Mr. LANCASTER. One other thing, Mr. Shuster, that I have already mentioned that you said, and that is, that we should have access to their research and make it available to our small business, or I think that is what you said.

How do we do that when we have had so little success in opening markets to our products? Surely they are going to be even more resistant to share their research with our small business, which may come back to face them in competitive products that they don't want to buy in the first place.

Mr. SHUSTER. What I have advocated is getting the knowledge, our own knowledge, American-developed knowledge to our small manufacturers. I believe that we should also make the many foreign data bases available to small businesses. Anything that can enhance their products or their competitiveness should be included.

I think if better products are what makes exports possible, then I think we can do something. At present we have some artificial barriers to knowledge access by small business. This bill would correct that.

Mr. LANCASTER. Thank you, Mr. Chairman.

Chairman LAFALCE. Thank you, Mr. Lancaster. Mr. Kammer, I remember when I first went to Japan in 1981, I went with an individual who was at the head of one of the Westinghouse divisions, Mr. Tom Murrin, now Deputy Secretary of Commerce.

I, at that time, first became personally and poignantly aware of what I considered to be the great Japanese challenge. There was no question in my mind that if the United States were to meet that challenge, we would have to enhance our competitiveness in a great many different ways.

One of those ways would be for the promotion for technology, for the transfer of technology, it seems to me that this was one of the great deficiencies of Government, whether it had been Government under a Democratic President or a Republican President, that was not the issue, we had not helped facilitate the transfer of technology that existed.

Almost 10 years later, it seems to me that is still one of our great deficiencies, except the problem has gotten much worse rather than better. Despite all good efforts, I am not sure that we have made very meaningful strides in our efforts to enhance technology transfer.

I think we are much worse off today, relatively, than we were a decade ago insofar as international competition is concerned. I think any data you look at would justify that.

By the same token, a lot of you have good ideas, but they just don't work. Sometimes our good ideas which cannot work are passed into law, and then they go on and on and on, and it doesn't work.

People say, we are solving the problem. We are not solving the problem; we are just adding layers of laws. But that is one of the reasons that I am so attracted to this bill, because it takes a program that it seems to me already has been tried and works. In a sense, we already have had a pilot.

If anything, I agree with some of the comments of Mr. Reddy and Mr. Anderson that this bill is too modest. But since we are very modest here, we proceed modestly in the first step, first instance. So you are going to have to show me.

Mr. Shuster says that he thinks this bill would be a milestone, the economic development of the United States. Mr. Reddy says the bill is excellent, but it's not nearly grand enough in scale. Don't go with 5, go with 15 States, so you can do something more comprehensively with the United States and regionally, et cetera.

You are going to have to show me where it's going to do even a little bit of harm where the administration is. Is the administration opposed to the bill, or is the administration just not enthusiastically embracing it or just not embracing it?

What is the position of the administration? Is it just that you think there is adequate legislation on the books right now?

Mr. KAMMER. Yes.

Chairman LAFALCE. But you wouldn't oppose this, would you? You just don't know that it's necessary?

Mr. KAMMER. The concepts that are contained in this legislation have already been endorsed by the administration.

Chairman LAFALCE. They endorse the concepts. This question is how we should implement it, right? Should the administration do it on its own, or should the administration be mandated to do this via legislation? Is that basically the administration's position?

Mr. KAMMER. Also the amount of money. There is a very parallel effort.

Chairman LAFALCE. That is a separate issue. We will get to that.

Mr. KAMMER. That seems to be the central issue, usually when all the discussion is over, is whether or not we have enough money to do all of these things at once.

The National Technology Transfer Center that has been created in Wheeling, West Virginia, is funded for, I think it's $28.3 or $4 million over the next 5 years for almost the same purpose, very, very close; and it's just starting.

Chairman LAFALCE. Almost the same purpose?

Mr. KAMMER. Almost; many of the other programs that I have——

Chairman LAFALCE. Let's go with all these programs that you talked about; OK? The technical administrations, the National Technology Service currently has two on-line data bases of developmental activities. What do you know about that, Mr. Shuster, Mr. Reddy, or Mr. Anderson? Is that in any way comparable?

Mr. SHUSTER. The Federal Government has many great data bases. In fact, they have 4,200 of them.

Chairman LAFALCE. It's the availability of those data bases.

Mr. SHUSTER. A hundred of them are on-line with private vendors, and they are quite accessible to large companies. We use them all the time in our service. They haven't been very accessible by small business. They haven't been available to small companies, to my knowledge, because there is no mechanism. There are many other data bases within the Federal Government that should also be included and made available to American business.

Chairman LAFALCE. Wouldn't this bill simply enhance the ability of the small business community to access the data bases that Mr. Kammer is talking about?

Mr. SHUSTER. Yes; it would, and it would also integrate over all these data bases for easy access. One of the problems, I think, is that many of these programs have been designed by somebody that really hasn't experienced the other end, the need.

Chairman LAFALCE. Could we talk a little bit about the user-friendly nature of this program, because I think that is important.

Mr. SHUSTER. Sure; if given a technology problem or an issue, the person in need can, within 10 minutes you can identify somebody that is an expert in that area and call them directly, number one. Or number two——

Chairman LAFALCE. Is there any program like that right now on the Federal level, Mr. Kammer?

Mr. KAMMER. The Federal Laboratory Consortium has been attempting to start such a program, but I couldn't say that it was up and running.

Chairman LAFALCE. OK; the answer is no.

Mr. SHUSTER. Also, if one of these small companies wants to look into the literature for assistance they can search the world's literature right from their desk.

One of the problems, by the way, to talk about Federal interaction, we have had—our private companies had difficulty working with national labs, and one of the reasons is because we insist on paying our experts.

We want to be able to control their behavior, but since we have been consistent paying them, national labs, some of them have told us that their people cannot participate in the way we would like them to participate, because they cannot use the Government phone for private income, even though we also provide a credit card so that an expert can call our client back. So it's just the overhead on the phone which is a zero number, and we suggest that we charge that against their technology transfer mandate.

We have had varying success. We have some retired Federal experts, and they are excellent. They are kind of a bridge between pure academia or academicism, or somebody from industry. They are hands on, but have a broad range of experiences.

Chairman LAFALCE. Mr. Kammer refers to the Federal research and progress data base available through DIALOG, which provides access to information about ongoing federally funded research activities in the fields of science, engineering, and life sciences. Anybody know anything about this?

Mr. SHUSTER. We use it all the time.

Mr. ANDERSON. We use DIALOG.

Chairman LAFALCE. Then, why don't we just use DIALOG rather than this bill?

Mr. SHUSTER. As I pointed out in my testimony, many of the small companies never heard of a data base, much less how to access them. They don't have the wherewithal to do it. Even if they were taught to access data bases themselves directly, they would never become more than about 25 percent proficient. They need help.

We have recommended interactive on-line access to data bases where a professional searcher is actually on-line with the user. They are locked together through PC's, and are doing the search together. The professional searcher knows the data bases inside and out, and the client knows the technology in which they have an interest.

Chairman LAFALCE. OK; so we have a search to work with the small business. The small business doesn't have to go to anything such as the in-progress data base independently. That is just one possibility. But this searcher working with the small business would be aware of not just the Federal research and progress data base, but virtually all data bases?

Mr. SHUSTER. I think that our clients presently have access to about 1,400 data bases, some of them European. They can search the patents of the world right from their desk.

Chairman LAFALCE. Would the same argument be true with respect to the technology-applied data base that Mr. Kammer refers to?

Mr. SHUSTER. I don't know if that is one of the data bases that is on line. Do you know that?

Mr. KAMMER. Yes; that is a data base that has listed all the Government-owned inventions that have been patented since 1981, I believe, and I suspect it's probably used by Mr. Shuster's organizations.

Mr. SHUSTER. Yes; we do use that. One thing I might mention is that a lot of these data bases seem to have been created with no specific organization in mind. They should be standardized to make them more usable.

Chairman LAFALCE. What about the NASA Industrial Application Centers?

Mr. ANDERSON. We are one of those centers, and we do not have access to as many data bases as Mr. Shuster's program, and we do not have access to the experts that they have. But we do use interveners in terms of helping clients define problems and certain selected data bases.

Chairman LAFALCE. How many NASA Industrial Application Centers are there? Do you know?

Mr. SHUSTER. About nine.

Chairman LAFALCE. About nine. Now, how would the NASA Industrial Application Center be similar to the program we are talking about? How would it differ? Would there be duplication at all?

Mr. SHUSTER. There is one NASA Application Center that probably comes the closest to what we are talking about, and they do searching for clients. They do batch searches. They are not interactive, and they claim to provide experts. I think this is a competitive response to our service. But they have done some good, no doubt.

By the way, Mr. Chairman, I think we point out that the benefit of technology transfer programs are so great they don't have to be very good to provide benefit.

Chairman LAFALCE. The National Aeronautics and Space Administration is not the entity you would imagine that is going to be able to reach out to the small business community of America, and I don't think the small business community of America envisions assistance from either NASA or NASA Industrial Application Centers; is that correct?

Mr. SHUSTER. I don't think so. Our clients have access to these data bases. They are mostly medium and large companies, but none of these programs reach enough small companies, period.

Mr. ANDERSON. We would suggest that NASA would be one component of an overall Federal effort.

Chairman LAFALCE. What about some of the other things that Mr. Kammer has mentioned; the State Technology Extension Program, the Boehlert-Rockefeller Program? I know that Mr. Boehlert is a cosponsor of a particular bill. What does that do, Mr. Kammer, that would duplicate it by the bill that I am talking about, or what does that do where there would be some inconsistency or contradiction between the effort that I am attempting?

Mr. KAMMER. One of the objectives of this program is to work with and through State and local officials to help small- and medium-sized companies identify, access and indeed apply Federal technology to their specific needs, which seems rather closely related. The first nine or seven centers were just selected this last week.

Mr. SHUSTER. May I comment on that?

Chairman LAFALCE. Yes.

Mr. SHUSTER. There are many State programs out there, and some are better than others. I think they all provide some benefit. Present programs recommended would strengthen all of these programs and bring at least 10 times more needed information and knowledge to small businesses. However, any State program where you don't bring in the Feds is greatly flawed. You can take Minnesota, and you can take any five States in this country and put them to it, and they don't have the technical resource that the Federal Government has. So this is why this bill, or the bill does call for these to be State programs where the Federal Government puts their stuff in a format where each State can bring it into their own programs.

So just simply put, no State program otherwise can be possibly as good as it could be without the Federal technical input.

Chairman LAFALCE. We could go on and on and on. Has anybody at the Department of Commerce ever attempted to take the entirety of a body of law that is applicable to technology transfer that has been introduced over the past several decades by different Congressmen, different administrations, and it's codified, but kind of harmonize it into one cohesive whole, Mr. Kammer?

Mr. KAMMER. The closest that we have come to that, and it certainly hasn't been harmonized, is last year we did a report which we submitted to Congress on the technology transfer activities resident in the States. I think the single most—I alluded to one of the pieces of data from that, there was about a half a billion dollars of activity.

But I think the most interesting instruction you could get from that was the variety of efforts in the States, and the strong ideas that existed in some States. You could also find some things that hadn't worked but that was useful, too. I think that is the best that I am aware of.

Chairman LAFALCE. I regret that I have an 11:30 commitment. I want to ask Mr. Wyden if he would assume the chair. Thank you.

Mr. WYDEN [presiding]. Gentlemen, just a couple of other questions. Mr. Kammer, I want to go through with you what we have gotten in response from the various agencies with respect to commercial licenses issued or assignment of patents. I am curious whether you think the system is working so well when you see what we are hearing from the agencies. After Dr. Bromley came to the Subcommittee on Regulation a year ago, we queried each Federal agency with respect to their progress in this area.

The Department of Energy in response to a question asking them to indicate the number of licenses or assignments each unit has made for the years 1987, 1988, and 1989, responded that there have been no licenses or assignment of patents in 1987, 1988, or 1989.

With respect to EPA, the answer is the same. There have been none issued in 1987, 1988, and 1989. With respect to the Department of Interior, they said in the Bureau of Mines, one part of the department, there had been three in 1987, five in 1988, and two in 1989. With respect to NASA in 1988 there were seven and three in 1989.

My sense is that is basically a formula for us to be noncompetitive in world markets, if that is what we are getting out of our labs over the last 3 years. That is not Ron Wyden's analysis. Those are the responses from the various agencies. How would you read it otherwise?

Mr. KAMMER. If I may, I will make three comments. The changes by Dole and Stevenson-Wydler changed the ground rules quite a bit for the Federal agencies, and prior to that, it really wasn't possible to do a license of a patent in any sensible way. So, the time in which the agencies have had to respond to this opportunity is not large. It's about 4 years.

Second, most of the agencies did not have as their primary mission—for good or ill, I simply observe this, they do not have as their primary mission the economic competitiveness of the United States, contributions to manufacturing technology, or improvements in products available in the economy.

Their missions are otherwise. To the extent that they contribute to the economy, it's viewed by those agencies as a side issue, not a fundamental desire of the agency.

Mr. WYDEN. Do you agree with that?

Mr. KAMMER. No; I don't, sir.

Mr. WYDEN. What are we going to do to shake it up?

Mr. KAMMER. This is part of that debate, the National Technology Competitiveness Act of 1988 was a lot of that debate. The creation of the Advanced Technology Program, I think, was a step forward.

I think a number of the other programs we have talked about make a contribution. If there are people who see the strategy in this whole form, I am not one of them. I know many of the parts,

but I am not personally at a stage where I am able to conceptualize the whole strategy.

Mr. WYDEN. I guess that is the other point I want to mention at this point. I feel badly that you have been sent up here to justify the administration's nonsystem and nonpolicy. You are clearly one part of the process, but not the whole game by any means. I think it is unfortunate you have had to come here. Please take this message back because I can't find on any one account where real progress has been made. I went back through the record of the hearing with Dr. Bromley who said that there should be a clearinghouse in each of the Federal labs of any significant size. That is on page 47 of the hearing in October 1989.

You said in response to my question that more than half of the labs did not have that kind of clearinghouse. Do you know whether there has been progress in increasing the number of labs that do have clearinghouses in the last year?

Mr. KAMMER. Yes, sir. I alluded earlier to a rapidly changing philosophy. I think DOE perception for a long time was that its fundamental missions were not relevant to competitiveness and they weren't willing to make the commitment. That has changed and the current Secretary of DOE, Secretary Watkins, has made a very strong commitment, which I think will be reflected. There will be results.

Mr. WYDEN. So what you are saying is that those abysmal numbers of 1987, 1988, and 1989, when the bipartisan majority of our committee queried the Department of Energy, are going to start turning around in 1990, 1991, and 1992 because of the new efforts?

Mr. KAMMER. Yes, sir, I believe they will. But I would also add to that, one of the things that Stevenson-Wydler created was the cooperative R&D Act opportunity, which is a corroborative effort between Federal laboratories and typically small businesses, but private sector businesses. Last year the U.S. Government signed over 500 of these agreements, which is a very big change. I mean this didn't exist 5 years ago at all. My own agency, a relatively modest one is signing on an average of one a week.

Mr. WYDEN. Mr. Shuster, let me ask you this. Isn't the key to really turning this around is a decision that the President and his top people, his science adviser, the Commerce Department, that this is going to be a priority? Congress keeps passing these bills, and they are good bills. The 1986 and 1988 legislation, hopefully will pass this legislation which has bipartisan support, but isn't it going to be necessary for the President and his top people to get the message down to the lab managers that this is a priority for them, and if that message doesn't get out, we can pass laws until we run out of paper to print them on and it isn't going to get done.

Mr. SHUSTER. It seems to me from what I read that there is strong support for the very kind of bill that was proposed today. We are offering a tested and proven program. I think the clearinghouse that we discussed a little earlier, in whatever form it takes, Mr. Reddy said it is a flyer, should be made available to every scientist and every engineer in this country—access at their PC, turn it on and find out what every lab is doing.

Chairman LAFALCE. You are being too logical.

Mr. SHUSTER. If somebody wants to know something about lasers, they should know that there are 80 people working on laser research, at Los Alamos, they should be able to identify that Dennis Gill runs the program, and call him directly.

Mr. WYDEN. What is striking to me is that not only do we not have easy access to technology, but that we just established 20 minutes ago that you and Mr. Reddy, who are certainly the leaders in terms of the small business community in this area, weren't even aware of this clearinghouse that Mr. Kammer was talking about. This clearly illustrates the Federal Government's inability to get the word out about these technology transfer issues.

The minority counsel made very helpful suggestions in my view. We would like to see Mr. Kammer, if you could provide the subcommittee with a description of the Federal Government's technology transfer programs, as well as a description of the foreign data base that exists. Could you get that to us within 2 working weeks?

Mr. KAMMER. Yes, sir.

[The information referred to may be found in the appendix.]

Mr. WYDEN. Let me see if counsel has any other questions.

Mr. HIATT. There were 100, I believe, that are available on line?

Mr. SHUSTER. Yes; you can get that right in Washington here. It is a little book about this thick that lists them all.

Mr. WYDEN. Gentlemen, this has been very a instructive, and, frankly, I think, very disturbing hearing. I came today in strong support of the LaFalce legislation, which I am a cosponsor of. But what I would have liked to have heard, Mr. Kammer, was about a variety of administration initiatives which would have made the need for legislation unnecessary. I think Chairman LaFalce would be very receptive to taking whatever steps are necessary so that our small businesses can get the assistance that they need.

But what we have heard today, that we need this legislation even more because in your own words, the system has gotten more complex, is certainly quite the opposite. Dr. Bromley has not sent us the plan which we were promised more than a year ago, and I can see very little of a constructive nature that has taken place in the last year to address this problem.

As far as this Member is concerned, I am going to stay with this until I don't have a breath in my body. I think it is outrageous that we are spending $60 billion of this countries' taxpayer money, and we have not been able to get the fruits of that federally funded research out to our small businesses who create jobs.

We don't create jobs in the Congress. We don't manufacture jobs. People like those who belong to Mr. Shuster's group and Mr. Reddy's group, they are the ones who create jobs. It is our job to help promote a climate in which they can go out and do their thing, which is to create jobs in the marketplace. The Federal Government isn't doing a very good job of improving that climate.

So please take the message back to Dr. Bromley. Our door is open. We are anxious to hear about any administration initiatives that they want to pursue. I think that there is an awful lot of work to be done to make sure that technology transfer really is transfer, rather than what we have heard today, which is some kind of convoluted process that may or may not be of some value, but is more

likely to miss than to hit. Unless anybody has anything to add, gentlemen?

Mr. Shuster?

Mr. SHUSTER. Yes; just having participated in this hearing, my feeling at the moment is that I am kind of sad. The benefits of the program are so obvious. We have shown the way. We have paid the price, and yet we have a major agency saying, hey, look, that ain't the way to do it. Show me a better way. Thank you.

Mr. WYDEN. You have paid a very great price yourself, having gone, in fact, out on a limb and being out in front, out there in the Midwest. Mr. Reddy, I think you all have done fine work as well.

Mr. Anderson, we welcome you. I happen to be a member of the Iowa Bar Association, so I have a fondness for your State. Gentlemen, we thank you. We have got a lot of work to do. The committee is adjourned.

[Whereupon, at 1:47 p.m., the committee was adjourned subject to the call of the Chair.]

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APPENDIX

OPENING STATEMENT OF JOHN J. LaFALCE, CHAIRMAN
COMMITTEE ON SMALL BUSINESS
HEARING ON H.R. 4659, TO CREATE A TECHNOLOGY ACCESS PROGRAM

September 5, 1990

Today we consider legislation to create a Technology Access Program, "TAP", which is designed to bring American small business to the technological frontier, to accelerate the rate of technological progress, and to improve the productivity and competitiveness of American industry. This bill, H.R. 4659, proposes something which is unique in the field of technology transfer and economic development; it proposes a system which would give businesses instant and easy access to the very best technical expertise in the world. It is hard to imagine a more user-friendly system. Recognizing the potential of this bill for American economic competitiveness, the House leadership recently adopted it as a lead item in its package of high-technology initiatives.

My involvement with the issue of technology and economic competitiveness extends back several years. As Chairman of the House Banking Subcommittee on Economic Stabilization in the mid-1980s, I held an exhaustive series of hearings on American economic competitiveness. As a result of those hearings, I introduced two major pieces of legislation: one to create a Competitiveness Policy Council, and the second, a bill to establish an Advanced Technology Foundation which would have funded research on generic technologies and collaborative R&D, and would have created a federal industrial extension service. I was pleased that the Competitiveness Policy Council, which will help to bring together representatives from industry, academia, and government to identify profitable areas for government-industry partnerships in developing new technologies and new industries, was enacted into law in the 1988 Trade Act, and has now received initial funding.

I took an interest in this subject area -- technology and economic competitiveness -- because I recognized that it was one in which government policy can have a truly profound effect on the quality of life. U.S. government policy has played a central role in some of the most important technological events in history, including development of the computer industry, the semiconductor industry, and the commercial aircraft industry. But perhaps the most striking example is the U.S. agricultural research and extension system, which for a century has funded agricultural research and disseminated new technology to farmers. The system has generated a rate of return far higher than that of typical private investments. Indeed, it is a major reason why agricultural productivity growth has been higher over the past 50 years than in any other sector of the American economy, and why

the U.S. has long been the undisputed world leader in agriculture.

The bill we consider today to create a Technology Access Program would replicate important features of the agricultural system on an economy-wide scale, using the latest computer and telecommunications technology. It is modelled on a Minnesota state program, Minnesota Project Outreach. It proposes what I regard as a unique form of technology transfer, unique in the degree to which it is user-friendly. Under TAP, a business in need of technical assistance does not have to call 14 people and wait 3 weeks in order to get help; it does not have to know the 10 different protocols needed to access 10 different data bases; and it does not need to hire a staff of information-retrieval experts. Technology transfer systems which operate that way -- and many do -- will never reach or help most of their potential customers. Under TAP, by contrast, all a business needs is access to a personal computer and a telephone in order have the very best technical expertise in the country -- indeed the world -- at its fingertips. I will leave it to our witnesses to elaborate on how the system works.

Anything can be made to sound nice in theory, however; the proof is in the pudding. To test whether this form of technology transfer actually works in practice, my staff surveyed a random sample of businesses that use the Minnesota program. The results were impressive and were the motivation for my introducing this bill. The businesses reported that their payoff in increased annual profits was more than 15 times their annual cost. These numbers suggest that a national Technology Access Program could make a real difference in the competitiveness and productivity of American industry.

The Technology Access Program has received support from many different sources, and the idea is gaining momentum. At this point, I would like to introduce the witnesses. They are:

Raymond Kammer, Deputy Director of the National Institute of Standards and Technology, Department of Commerce;

Joseph Shuster, Chief Executive Officer of Teltech, in Minneapolis, Minnesota;

Leo Reddy, President, National Coalition For Advanced Manufacturing;

Lloyd Anderson, Director, Center For Industrial Research and Service, Iowa State University

SECTION-BY-SECTION ANALYSIS OF H.R. 4659, A BILL TO CREATE A TECHNOLOGY ACCESS PROGRAM (TAP)

Section 1 establishes a 5-year Technology Extension Pilot Program

PURPOSE -- The purpose of the program is to improve access by businesses in participating states to federally-funded technology and technical experts, as well as to equivalent state-level technology and experts, in order to accelerate technology transfer and improve productivity and economic competitiveness.

ACTIVITIES -- The Secretary of Commerce, acting through the Director of the National Institute of Standards and Technology (NIST), would be authorized to:

(1) Create a data base of research projects in Federal laboratories, other federally-supported research, information available from the National Technical Information Service, patents available for license from federally-funded research, other government technology resource services, and technology transfer services available at federal laboratories and the Federal Laboratory Consortium;

(2) Create a network of experts in Federal laboratories and elsewhere to answer business' technical questions by telephone;

(3) Establish interactive access by businesses to other data bases of technical and business information in print.

DATA BASE CONTRACTOR -- The data bases and network of experts will be created by a non-Federal private contractor, selected on a competitive basis, who will be required to provide a staff of information searching professionals to facilitate interactive access to the data bases.

STATE PARTICIPATION -- Up to five states shall be selected, on a competitive basis, to participate in the program. To be eligible, a state shall provide matching funds and establish a data base of State research projects, licensable technologies, state services, and a network of state experts.

FEES CHARGED TO BUSINESSES -- Businesses with gross annual sales of $5 million or less will not be charged for accessing the program; businesses with sales between $5 and $15 million will be charged at a reduced

rate for the first few years; businesses with sales over $15 million will be charged full cost.

PROGRAM EVALUATION -- The program will be evaluated after 3 years and again after 5 years, and the Secretary of Commerce will report findings to Congress.

AUTHORIZATION OF APPROPRIATIONS -- $2 million is authorized for this pilot program for FY 1991 and $3 million for each of FY 1992, 1993, 1994, and 1995.

Section 2 establishes the Small Business Development Center (SBDC) Technical Assistance Program

ACTIVITIES -- Any existing SBDC may apply for an additional grant to increase access by small businesses to the online data bases created in section 1 and/or other data bases. The SBDC may increase access by defraying the cost of access, training businesses in the use of the data bases, and demonstrating the benefits of access.

AUTHORIZATION OF APPROPRIATIONS -- $5 million is authorized for the SBDC program for each of FY 1991, 1992, and 1993.

HEARING STATEMENT
REP. RON WYDEN

H.R. 4659: A BILL TO CREATE A TECHNOLOGY TRANSFER PROGRAM
TARGETED AT U.S. SMALL BUSINESS
BEFORE THE COMMITTEE ON SMALL BUSINESS

SEPTEMBER 5, 1990

MR. CHAIRMAN, I congratulate you and your staff on the development of this legislation. I'm proud to be an original co-sponsor because I'm convinced that this program will help shepherd new technologies -- priceless discoveries from our multi-billion-dollar-per-year, federal laboratory network -- to the folks who need them the most, our domestic small businesses.

To those not intimately involved in this process, our work today may seem esoteric. But in the real world, the expeditious commercialization of these lab discoveries could bring new telecommunications systems, increased automotive gasoline mileage, or even a cure for AIDs.

During the last year we've found that the 700 federal laboratories are a treasure trove of practical knowledge applicable to a wide range of commercial fields, from medicine to metallurgy. I call these technologies our keys to the competitive kingdom. In an increasingly competitive global economy, they will help determine whether new businesses succeed or fail, whether jobs are created or lost.

But it is also quite clear from our investigation that big gaps exist in our efforts to transfer and commercialize these scientific breakthroughs. These problems are attacked in our bill in a sensible and cost-conscious fashion.

To do less would be to encourage further under-utilization of a tremendous -- and tremendously expensive -- public resource. Fifty cents of every research dollar invested in this country is spent at a federal or federally supported lab.

Mr. Chairman, at this point I'd like to submit for the record a memorandum developed on this subject by staff of the Subcommittee on Regulation, Business Opportunities and Energy, which I chair.

Briefly, these are some of its conclusions:

-- If government labs were profit-making organizations dependent on selling their wares, they would have gone into Chapter 11 long ago. According to the General Accounting Office, 1988 royalties on commercialization of $60 billion worth of federal research totalled only $3 million.

That's a return on investment of only .00005 percent. This is not the only way to measure our transfer capability, but it certainly demonstrates that we have a problem.

-- One former, long-time Presidential science aide complained to subcommittee staff that less than 10 percent of the inventions created in government-owned and operated labs -- funded at about $20 billion per year -- are ultimately transferred to private industry. Even less is finally commercialized into products.

-- The memorandum contains several case histories demonstrating the red-tape roadblocks set up by laboratories to discourage private purchasers of government lab technologies. These range from simply having no technology transfer officer or mechanism, to creating needlessly complex security clearance systems.

-- Some government labs and agencies have simply ignored key provisions of federal transfer laws. For example, some government labs have not yet developed rules and guidelines for commercialization of lab inventions, a key step in the transfer of federal technology.

-- Finally, there is no top-level Administration executive with clear and overriding authority demanding and achieving better technology transfer in federal labs. Commercialization efforts largely occur at the whim of individual lab directors, and if they're not interested it doesn't happen.

Mr. Chairman, Dr. Alan Bromley, director of the White House Office of Science and Technology Policy, testified on this subject before my subcommittee last October. He assured us that he understood the problems stalling commercialization, and that enhanced tech transfer would be a key piece of his overall science policy. But those assurances are now almost a year old, and so far I've seen nothing on paper to back up Dr. Bromley's promise.

We need a hammer, a high-level Administration figure, to pound home the importance of technology transfer. But so far, the Administration has chosen to stand on the sidelines. It has neither clearly identified technology transfer as a priority nor taken the steps necessary to provide top-level coordination of technology transfer policies.

As a result of this sorry state of affairs, I'm afraid that we're doomed to see a continuation of business-as-usual, and an unfriendly attitude toward commercialization at many federal laboratories.

In the absence of an aggressive approach by the Administration, I'm pleased that this committee is opening the laboratory door, if only by a crack.

Statement of the Honorable Joseph M. McDade
Vice Chairman
Committee on Small Business
U.S. House of Representatives
September 5, 1990

Mr. Chairman, I appreciate your convening this hearing today to address the issue of technology access for our nation's small businesses. I commend you for calling attention to a matter that is of extreme importance in a day and age of increasing competitiveness in world markets.

Throughout the 1980's, advances in technology and productivity posted by major industrial nations, such as Japan and West Germany, have challenged the United States' long-standing role as the undisputed world leader in business. This situation is apparent, and I am sure that the testimony today will present various ways to remedy this problem.

However, it is clear to me that many small business owners and those wishing to start businesses must regain the technological edge that made America great in order to be able to compete effectively at home and abroad. Without access to technology, American industry cannot long remain healthy and competitive.

Technology sharing is already practiced among American businesses, yet the availability of technology access for small businesses remains limited. However, the federal government retains a large depository of technology, that if effectively tapped and commercialized, could increase the prospects of even greater economic growth and prosperity.

America's leadership in the world economy can be directly attributed to its ability to innovate. It has been so in the past and it will remain so in the future. American industry must find new ways through access to technology to develop new products, spur economic growth and again reach a high level of global competitiveness.

101ST CONGRESS
2D SESSION

H. R. 4659

To establish a program to improve access by small and large private businesses to technical information and expertise within the Federal Government and selected States.

IN THE HOUSE OF REPRESENTATIVES

APRIL 26, 1990

Mr. LAFALCE (for himself, Mr. WYDEN, Mr. BOEHLERT, and Mr. BROOMFIELD) introduced the following bill; which was referred jointly to the Committees on Science, Space, and Technology and Small Business

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A BILL

To establish a program to improve access by small and large private businesses to technical information and expertise within the Federal Government and selected States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Technology Extension Service Act of 1990".

SECTION. 1. (a) ESTABLISHMENT OF TECHNOLOGY EXTENSION PILOT PROGRAM.—In addition to such other technology resource and technical information activities of the Department of Commerce's Technology Administration, the Secretary of Commerce (hereafter in this Act referred to

as the "Secretary"), acting through the Director of the National Institute of Standards and Technology (hereafter in this Act referred to as the "Director"), is authorized and directed to create a Technology Extension Pilot Program (hereafter in this Act referred to as the "Program"). The Program shall run for five years from the date of enactment of this Act.

(b) PURPOSE.—The purpose of the Program shall be to provide private businesses, in States selected under subsection (e) of this section to participate in the Program, with improved access to Federal and federally funded technology and expertise, as well as to equivalent technology and expertise from States and other sources, in order to accelerate the transfer of government-supported technology and expertise to businesses and to improve the productivity and economic competitiveness of these businesses.

(c) ACTIVITIES.—The Program shall consist, to the extent the Secretary and Director deem appropriate, of the following:

(1) A data base, accessible by computer to private businesses in participating States, which contains information on—

(A) research projects in Federal laboratories;

(B) other federally supported research projects, including research in universities;

(C) reports and other documents available from the National Technical Information Service;

(D) patents available for licensing from Federal laboratories and from federally funded research projects;

(E) other technology resource services available from the Federal Government and participating State governments; and

(F) technology transfer personnel and services available at Federal laboratories and the Federal Laboratory Consortium for Technology Transfer.

(2) Direct access to experts in Federal laboratories and elsewhere who are available, under terms to be set by the Secretary, to answer technical questions by telephone.

(3) Interactive access to data bases of technical and business information in print.

(d) DATA BASE CONTRACTOR.—The Secretary, acting through the Director and using a competitive selection process, shall select a non-Federal data base contractor to create the Program's Federal data bases and network of experts and to manage them for the duration of the Program. The contractor must be able to provide access to experts other than, and complementary to, State and Federal experts. The con-

tractor will further be required to provide a staff of information searching professionals to facilitate interactive accessing of technical and business information in print, as well as Federal and State data bases.

(e) PARTICIPATING STATES.—Within twelve months from the date of enactment of this Act, the Secretary, acting through the Director and using a competitive selection process, shall select up to five States for participation in the Program. To be eligible for selection, a State shall provide such matching funds as the Secretary shall deem appropriate and shall establish a data base of State research projects, licensable technologies and State services, as well as a network of experts available within the State.

(f) FEES CHARGED TO BUSINESSES.—Private businesses within participating States that wish to take advantage of the information and other services provided by the Program shall be charged as follows—

(1) for businesses with gross annual sales of $5,000,000 or less, no charge; and

(2) for businesses with gross annual sales greater than $5,000,000 but less than $15,000,000 no charge during the first year after States are selected, 25 per centum of cost of providing that information and services to the business during the next year, 50 per

centum during the year after that, and 100 per centum thereafter.

(g) COOPERATION.—The heads of Federal departments and agencies shall provide the Secretary with such information and assistance as the Secretary may request in order to carry out the requirements of this Act.

(h) EVALUATION AND REPORT.—After three years of Program operation, and again after the end of the Program, the Secretary shall evaluate Program operations and business use of the Program and shall report findings to the appropriate committees of Congress.

(i) AUTHORIZATION OF APPROPRIATIONS.—To carry out the Program established under section 1 of this Act, there is hereby authorized to the Secretary the following amounts—

(1) for fiscal year 1991, $2,000,000; and

(2) for each of fiscal years 1992, 1993, 1994, and 1995, $3,000,000.

SEC. 2. (a) SMALL BUSINESS DEVELOPMENT CENTER TECHNICAL ASSISTANCE PROGRAM.—The Small Business Act (15 U.S.C. 648) is amended by adding the following new section:

"SEC. 24. (a) Any applicant which is funded by the Administration as a Small Business Development Center may apply for an additional grant to be used solely to increase

access by small businesses in its service area to online data bases for the purpose of facilitating technology transfer, such as that created by section 1 of this Act or other privately or publicly funded data bases. The Small Business Development Center may seek to increase small business access by—

"(1) defraying part or all of the cost of access to the data bases for a limited period of time;

"(2) training small businesses in use of the data bases; and

"(3) demonstrating to small businesses the benefits of accessing the data bases.".

"(b) AUTHORIZATION OF APPROPRIATIONS.—There are hereby authorized to be appropriated to the Administration for each of the fiscal years 1991, 1992, and 1993 the sum of $5,000,000 to carry out the provisions of section 2(a) of this Act.".

UNITED STATES
DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS
AND TECHNOLOGY

DEPARTMENT OF COMMERCE
RAYMOND G. KAMMER, DEPUTY DIRECTOR,
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
BEFORE THE COMMITTEE ON SMALL BUSINESS
U. S. HOUSE OF REPRESENTATIVES
SEPTEMBER 5, 1990

Mr. Chairman and Members of the Committee. I am Ray Kammer, Deputy Director of the National Institute of Standards and Technology I am here to discuss the proposed legislation for improved access to technical information and expertise within the federal government. As the only federal agency with a direct mission to support industry, we are particularly concerned about technology transfer and industry assistance.

The United States has a long history of technological expertise and ingenuity. American scientists pioneered projects such as the video recorder, transistor electronics, and machine tool centers. Yet, compared to foreign competitors, US companies have been slow to commercialize these technologies. It is not enough to be the first to develop a new technology if we are unable to effectively bring the technology to commercial market. The problem of applying and commercializing new technology is complex and there are no easy solutions. Limited access to federal technology and expertise, particularly by small and medium size businesses, is certainly part of this problem. We commend this committee's continuing efforts to improve that access.

The bill currently before us, HR 4659, seeks to improve the technology transfer process by providing single point, interactive access to a database of federally funded research and development activities, as well as technology transfer personnel. The program would include a remotely accessible database of all federal and federally funded research, technology and services, a remotely accessible database of technical and business information in print, in both the private and the public sectors, and direct telephone access to technical experts in federal laboratories as well as private industry. The bill also calls for direct, interactive assistance to facilitate database access and utilization.

There is no question that the activities outlined here present excellent tools for federal technology transfer and information dissemination. Databases provide a wealth of information and the proposed interactive assistance will help ensure that those who need the information will actually be able to find and use it.

However, valuable as these tools are, we do not need additional authorizing legislation to develop and/or implement them. In fact, many of these activities are already on-going at some level under existing authorization. There are already numerous on-line databases of federally funded technology. The Technology Administration's National Technical Information Service currently has two on-line databases of federal research and development activities. The Federal Research In-Progress Database,

available through Dialogue, provides access to information about on-going federally funded research activities in the fields of physical sciences, engineering and life sciences. The Federal Applied Technology Database allows industry access to more than 8,000 government-owned inventions issued since 1981. The Department of Defense, NASA and DOE also have their own on-line databases and will provide direct access to responsible personnel.

Interactive assistance with these and other existing databases is already being provided through the NASA Industrial Applications Centers. The Industrial Applications Centers (IAC) program was established in 1970 specifically to provide technical solutions for industry problems. NASA IACs have access to over 500 on-line databases, including 60 to 70 federal databases and will provide contacts with technical experts in both the federal government and private industry.

Small Business Development Centers are also providing single point, interactive, access to a number of information databases and federal technology transfer agents. The SBDC program has an information service in Athens, Ohio that reportedly provides information search services for centers around the country. They can search existing databases of federal technology and have access to expertise in federal laboratories through the Federal Laboratory Consortium. The FLC has also established a clearinghouse containing broad descriptions of federal technology to assist federal technology transfer agents gain access to other federal laboratory technologies.

The list of these types of activities is long, and I am not even including private providers of information databases or access to information databases such as Dialogue Information Services, Inc. With this many players and this many programs, the individual small businessman finds it almost impossible to locate the exact information that he needs in a timely fashion.

NIST is the only federal agency with a direct mission to support industry. The Technology Competitiveness Act of 1988 recognized NIST's leadership role in stimulating cooperative work among private industrial organizations to solve technology problems and enhance industrial technology. The Act restructured the agency to augment its role in improving the competitiveness of U.S. industry with added authority for technology transfer and industry assistance activities. The Act established the State Technology Extension Program, now called the Boehlert-Rockefeller Program, to provide technical assistance to state technology programs throughout the US to enable those programs to help local businesses and increase competitiveness. The program works through and with state and local outreach programs to help small and medium size businesses identify, access and apply appropriate federal technology to their technical problems. Technology agents work through existing programs, such as the Small Business Development Centers or the NASA IAC's, and depend heavily on federal technology databases and other federal technology services as the tools of technology transfer.

In addition, the Technology Competitiveness Act established within the Technology Administration the Clearinghouse for State and Local Initiatives on Productivity, Technology, and Innovation. Current information on Federal, State and local programs is fragmented among providers and is difficult to access. The Clearinghouse is designed to be a central resource for sharing information on state and local initiatives, programs and experiences; and a source of analysis as to the variety and effectiveness of these various initiatives. The Clearinghouse will provide a mechanism whereby federal,

state and local governments can work together as partners to share information and expertise to enhance the contribution that technology can make to competitiveness and economic development.

The Competitiveness Act also established the Regional Centers for the Transfer of Manufacturing Technology for the purpose of "enhancing productivity and technological performance" through a variety of mechanisms including technology transfer activities and information dissemination. Three centers currently exist. The Centers work hands-on with small and medium size firms to modernize their manufacturing processes and improve competitiveness. The centers provide up-to-date, practical information and expertise, helping companies with technology adoption and implementation.

The Technology Competitiveness Act is of course just one of many pieces of recent legislation directed toward technology transfer and industry assistance. The Bayh-Dole Patent and Trademark Amendments of 1980 was one of the first laws passed in the effort to improve technology transfer. Also in 1980, Congress enacted the Stevenson-Wydler Technology Innovation Act which made federal technology transfer the responsibility of each federal laboratory. It provided the authorization for the Technology Administration's Center for the Utilization of Federal Technology which currently operates the NTIS federal technology database. The Stevenson-Wydler Act was amended by the Federal Technology Transfer Act of 1986 to further improve the technology transfer process. The Federal Technology Transfer Act also formally established the Federal Laboratory Consortium for Technology Transfer "to promote rapid movement of Federal laboratory research results and technologies into the mainstream of the U.S. economy."

Most recently, congress authorized funding for the National Technology Transfer Center to be established in Wheeling, West Virginia. This center is to serve as a national focal point for accessing federal resources and hopes to act as a catalyst for accelerating private sector utilization of federal technology. The center will compliment existing federal technology transfer services, including IAC's, Federal Laboratory Consortium and the Small Business Development Centers. The primary focus on technology access will be supported by outreach and network development activities directed toward increasing private sector awareness and use of technology transfer resources nationwide. In conclusion, I think it is important to reiterate that the proposed legislation, HR 4659, is technically sound and the activities described are important tools for technology transfer and industry assistance. However, new legislation for these activities is not necessary. Authority for these activities is included in the Technology Competitiveness Act as well as other technology transfer legislation, as indicated earlier in my testimony. Furthermore, and perhaps more importantly, most of this activity already exists at some level either in the government or the private sectors. It is important in this period of fiscal austerity that we not spend time and money reinventing the wheel. We must be careful to coordinate our existing resources and ensure that our efforts are not so fragmented that no program is able to operate effectively. Yes, the ideas presented in this bill are important to American industry, but we must recognize that these goals can be achieved under existing programs.

RAYMOND G. KAMMER

Deputy Director
National Institute of Standards and Technology (NIST)
(Formerly National Bureau of Standards (NBS)
United States Department of Commerce

Ray Kammer is Deputy Director of NIST. NIST is the Nation's central laboratory for measurement and standards research in support of U.S. industrial needs.

A graduate of the University of Maryland, Kammer joined NIST in 1969 as a technical program analyst. Over the following decade he served the agency and the U.S. Department of Commerce in a succession of offices concerned with budgetary and program analysis; planning; and personnel management. In 1980, Kammer was appointed Deputy Director of NIST.

In addition, Kammer has served as chairman of several important evaluation committees for the Department of Commerce, including reviews of satellite systems for weather monitoring and the U.S. LANDSAT program, and the next generation of weather radars used by the U.S. government. He just completed a three-year term in December 1989 on the Board of Directors of ASTM, a major international organization for the development of voluntary standards for materials, products, systems and services. Kammer has been appointed a member of the ASTM Finance Committee for a one-year term commencing January 1, 1990.

His awards include both the Gold and Silver medals of the Department of Commerce, the William A. Jump Award for Exceptional Achievement in Public Administration, the Federal Government Meritorious Executive Award, and the Roger W. Jones Award for Executive Leadership.

February 1990

The Federal Technology Transfer Act of 1986:

The First [redacted] Years

Report to the President and the Congress from the Secretary of Commerce
July 1989

THE SECRETARY OF COMMERCE
Washington, D.C. 20230

JUL 05 1989

The President
The White House
Washington, D.C. 20500

Dear Mr. President:

It is my honor to transmit to you and to the Congress the first report on the extent to which federal agencies are using the authorities vested in them by the Federal Technology Transfer Act of 1986. This report is required on a biennial basis by Section 3710(g)(3) of Title 15, United States Code.

The report comes at a time of challenge to our Nation's technological leadership. The signs are everywhere. The rate of increase in research and development in the United States is declining. Foreign applicants are obtaining increasing percentages of patents issued in this country. U.S. industry has become increasingly dependent upon foreign-born scientists and engineers.

Nevertheless, this Nation is determined to retain its scientific and technological leadership. Tax and antitrust policies have been adopted that, as President Reagan's last Economic Report stated, "have strengthened incentives for the private sector to put the results of R&D into commercial use." Congress and the executive branch have protected our Nation's innovators through strengthened intellectual property laws and unwavering insistence on international respect for such rights. Funding for basic research through the National Science Foundation has been substantially increased.

With so much at stake, a top priority must be to get more commercial value from our enormous $63 billion annual federal investment in research and development. It is important that we continue to invest in generating new knowledge. However, we must also make sure that the knowledge generated at federal laboratories or developed elsewhere with federal support contributes to long-term U.S. competitiveness in the form of new products, new processes, new industries, and new jobs.

This report focuses on one of our greatest national resources - federal laboratories. Much of the work done in federal laboratories is at the cutting edge of technology. With proper incentives and management tools, this technology can be transferred successfully to the private sector for commercial development. The Federal Technology Transfer Act provided these incentives and tools.

As the report indicates, although many viewed the Act as a challenge to their long-held views on the proper role of federal laboratories and scientists, most agencies have eagerly embraced it and are implementing the law as Congress intended. I believe that in future years we will look back on this Act as one of the seminal developments in the history of federal efforts to put technology to work for the taxpayers who paid for it.

Although the Stevenson-Wydler Technology Innovation Act calls for a biennial report of somewhat broader content, much of that ground was covered in the June 1988 report by your Office of Science and Technology Policy entitled "Progress in Facilitating Access to Science and Technology, Highlighting Superconductivity."

I look forward to working with you to ensure that this Nation maintains its technological leadership.

Sincerely,

Robert A. Mosbacher

Enclosure

THE SECRETARY OF COMMERCE
Washington, D.C. 20230

JUL 0 5 1989

Honorable Dan Quayle
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

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Some problems remain. The Act does not provide a suitable basis for commercializing the valuable software that is often produced at federal laboratories. Laboratory officials tell us that the private sector remains concerned that valuable information generated under these agreements may be inadequately protected from disclosure to competitors.

Nevertheless, the inescapable conclusion is that the Act is achieving its intended purpose of linking the research capabilities of federal laboratories with the research needs of U.S. business and is fostering a new era of public and private sector cooperation for the benefit of all Americans.

Sincerely,

Robert A. Mosbacher

Enclosure

THE SECRETARY OF COMMERCE
Washington, D.C. 20230

JUL 05 1989

Honorable Thomas S. Foley
Speaker of the House of Representatives
Washington, D.C. 20515

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Robert A. Mosbacher

Enclosure

FEDERAL TECHNOLOGY TRANSFER ACT OF 1986: THE FIRST TWO YEARS

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THE FEDERAL TECHNOLOGY TRANSFER ACT: THE FIRST TWO YEARS

EXECUTIVE SUMMARY

The Federal Technology Transfer Act (FTTA) of 1986 (P.L. 99-502) was designed to provide a bridge between the superb research facilities of government-owned, government-operated (GOGO) laboratories and the research needs of the private sector. At the time it was pending in Congress, United States citizens were investing more than $50 billion annually in R&D. Many in Congress and the Executive branch believed that this investment, however vital for federal programs, was not returning to the taxpayers sufficient dividends in terms of new products, new processes, new jobs, and enhanced international competitiveness.

Reflecting the principle that those who best understand a technology and its economic potential are the ones who created it, the FTTA authorized agency heads to delegate to their GOGO directors the authority to enter into cooperative research and development agreements (CRADAs) with private firms and other appropriate parties, to agree in advance on rights the parties could expect in any inventions made by a federal scientist under the CRADA, to reward the inventor with at least 15% of any royalties received by the agency from the invention, and to review and clarify the missions of their laboratories.

In doing so, the FTTA required a change in prevailing agency practice and management prerogatives by transferring power from headquarters to the field. Some were concerned that the Act could interfere with agency management responsibilities, that it could divert attention from mission-related research, and that commercial considerations could discourage the free exchange of scientific information.

Under these circumstances the Department of Commerce, which plays a general oversight and coordinating role, was concerned that the Act would be interpreted in the narrowest possible manner. Instead, the Department found the following:

- Most agencies with substantial GOGO activity are relying on the FTTA and have completed the necessary internal administrative arrangements for implementing it. Although the delegations vary in scope, most have attempted to delegate authority to the smallest unit that can be realistically called a laboratory. The National Aeronautics and Space Administration is the one major research agency whose organic statutes, rather than the FTTA, guide their technology transfer policy. The Department of Commerce will continue to monitor the various agency arrangements to ensure that the principle of decentralization is preserved.

- As of the close of FY 1988, agencies had negotiated more than 100 CRADAs and the pace has accelerated in the current fiscal year. Several agencies believe that even though some of this research may have occurred under other authorities, the FTTA nevertheless provides a much more useful tool for structuring the collaborative arrangements.

- The FTTA has spurred agencies to think creatively in developing technology transfer initiatives. Examples include USDA's Peoria Biotechnology Consortium and the Army's Construction Productivity Advancement Research (CPAR) Program.

- The incentives to federal scientists appear to be working beyond expectations. Agencies have been generous in using their royalty-sharing authority, in some cases allowing inventors to retain as much as 35% of the royalty income. The number of reported inventions increased by more than 40 percent in some agencies between FY 1987 and FY 1988. Although CRADAs are too new to have generated royalties, the pattern of payments to inventors under the Bayh-Dole Act (P.L. 96-517, as amended), including the Department of Energy's government-owned, contractor-operated facilities, suggests that substantial royalties may be generated.

Nevertheless, there are still obstacles to be overcome:

- Barriers to commercialization of Federally developed software are still a problem. Software often has substantial commercial value which may not be realized because most U.S. firms will not make the investment necessary to bring it to the marketplace without adequate proprietary protection.

- Agencies repeatedly report that private sector collaborators worry that proprietary data will be made available to their competitors through FOIA. Such concerns may have deterred some firms from seeking to enter into CRADAs.

- The private sector does not always use federal facilities when they might. In order to facilitate identification of relevant areas of cooperation, agencies must continuously examine and define their laboratories' missions, as required by the FTTA, especially in those cases where the program justification is not clear. Foreign entities, on the other hand, are adept at identifying valuable research projects at federal facilities.

In general, agencies heads and laboratory personnel have greeted the Act with enthusiasm. U.S. firms are becoming increasingly aware of its relevance to their needs. The FTTA may well be creating the framework for a new era of scientific cooperation between the public and private sectors.

THE FEDERAL TECHNOLOGY TRANSFER ACT: THE FIRST TWO YEARS

1. Introduction and Overview

Enactment of the Federal Technology Transfer Act (FTTA) of 1986 (P.L. 99-502) was largely a response to the increasingly tough international economic competition facing the United States. By all accounts, this competition will intensify as more countries, anxious to promote their economic development, enter the high technology competition. This is a healthy competition. The United States, however, will be unable to meet this challenge if it takes its technological leadership for granted.

Remaining competitive in fields such as superconductivity, biotechnology, new materials, pharmaceuticals, and other research-intensive areas could depend in large measure on our ability to link more closely our unsurpassed public research institutions with the needs of the private sector. U.S. industry's cooperation with universities and federal laboratories will become even more critical in determining whether we will be able to remain on the cutting edge of technology.

The Federal Government funds a substantial share of the R&D performed in this country - some 47%, according to the 1989 Economic Report of the President. Thus, a substantial share of the world's new scientific knowledge is paid for by the U.S. taxpayer. If this public investment is not translated into new jobs, products, and processes, we will have lost a significant opportunity for improving this nation's economic position.

The FTTA was enacted in response to these concerns. This law, along with former President Reagan's multi-phased program for improving access to federally funded research contained in Executive Order No. 12591, charged Federal agencies with linking their government-owned, government-operated (GOGO) laboratories to the private sector. This report summarizes how agencies have prepared to meet these challenges in the more than two years that have passed since the FTTA became law.

Most federal agencies have now completed, or are close to completing, the internal administrative arrangements necessary for managing programs of cooperative research with the private sector, universities, and state and local governments under the Act. Many have begun to negotiate agreements and a number of these have already been put into effect.

In general, agencies have made substantial progress and have developed firm foundations for successful technology transfer operations. By necessity, they concentrated first on resolving sensitive internal questions of control and accountability. Now they are addressing the practical problems of attracting the interest of the private sector and designing appealing arrangements.

To help them accomplish this and to ensure that Congress is kept fully informed on their progress, the FTTA required the Secretary of Commerce to: (a) report to Congress every two years on how agencies are using their new authorities, (b) report to Congress on barriers to the commercialization of computer software and on the feasibility of maintaining an inventory of federally funded training software, and (c) provide agencies with model cooperative research and development agreements and other appropriate technical assistance.

Taking these in order, this report is the first of the biennial reports required by the FTTA. It is based on information provided to the Department by agencies represented on the Interagency Committee for Federal Laboratory Technology Transfer, a forum established by former Secretary of Commerce Malcolm Baldrige to provide a continuing high level mechanism for addressing problems in implementing the Act and developing solutions. It is also based on follow-up questions and discussions within the Committee's Executive Working Group, a forum of senior headquarbters and laboratory personnel which meets on a regular basis and which has become an important support network for addressing the practical problems agencies face in implementing the law and Executive order.

Major agencies providing information included the Departments of Agriculture (including the Forest Service and the Agricultural Research Service), Commerce (including the National Institute of Standards and Technology, the National Oceanic and Atmospheric Administration, and the National Telecommunications and Information Administration), Defense (including the individual military departments), Energy, Health and Human Services (including the Public Health Service agencies), Interior, Transportation, and Veterans Affairs, as well as the Environmental Protection Agency and the National Aeronautics and Space Administration.

The report on barriers to commercialization of software and on federal training software was submitted in May, 1988. These barriers are discussed in this report in Section 9.a.

As to technical assistance, the Department has provided agencies with draft model agreements and continues to work with them on technical issues through the Interagency Committee and its Executive Working Group. This Group has met 13 times. In addition to the development of model agreements for working with industry, the Group has addressed model delegations of authorities for federal laboratories, employee conflict of interest issues, impact of the Freedom of Information Act, access by foreign companies and scientists to federal laboratories, protection of intellectual property in international science and technology agreements, problems in commercializing computer software, and training laboratory personnel in technology transfer.

But the real credit goes to the individual agencies. Their accomplishments have been particularly gratifying, given the many

obstacles that had to be overcome before the FTTA could be successfully implemented. These obstacles must be understood if progress to date is to be evaluated properly.

First, the FTTA challenged the status quo. As a general observation, the FTTA forced many agencies to confront and reassess long-held attitudes with respect to:

- the role of federal laboratories and scientists in promoting joint R&D with industry and transferring the results to the marketplace,
- the necessary methods and incentives for accomplishing this, and
- the relationship between the laboratories and their parent organizations.

These various factors are discussed more fully in the pages that follow. Evidence has shown to date that most agencies are taking advantage of the opportunities the new law afforded them. Agency personnel at headquarters and in the laboratories are making sincere efforts to implement the new law as the President and Congress intended. Many practical problems have been resolved.

In short, federal technology transfer has gotten off to a good start and can look forward to a very promising future.

2. Technology Management Principles and the FTTA

The fundamental objective of the FTTA is to promote U.S. competitiveness by allowing the private sector to pursue original R&D with our public research institutions, and by adapting the fruit of that research to the marketplace.

By 1986, Congress began to examine how the U.S. could reap substantial commercial returns on the $52 billion (now up to $63 billion) annual federal investment in research and development. A common complaint heard was that the U.S. wins Nobel Prizes while other countries walk off with the markets.

The designers of the FTTA responded by building upon certain fundamental principles:

- First, the federal government will continue to underwrite the cost of much important basic research in scientifically promising areas that takes place in the United States.
- Second, transferring this research from the laboratory to the marketplace is primarily the job of the private sector, with which the Federal Government should not compete.
- Third, the Federal Government can encourage the private sector to undertake this by judicious reliance on market-

oriented incentives and protection of proprietary interests.

These principles were first tested by the Bayh-Dole Act (P.L. 96-517) upon which the Federal Technology Transfer Act was modeled. The Bayh-Dole Act generally allowed universities and small businesses to elect to own inventions made by them with federal funding and required universities to share royalties with the inventor. This was accomplished without diverting the universities from their primary educational missions.

That Act has been very successful in promoting university-industry cooperation. In its April 1987 report to Congress (GAO/RCED-87-44), the General Accounting Office found that such cooperation had increased 74% since passage of the Act.

Certain fundamental factors to the university successes quickly became evident:

- First, the translation of technology into commercial products usually requires the full cooperation and involvement of the people who created it and who best understand its potential. Research reports can never hope to convey all that the researchers have learned and absorbed. This is especially so in the case of federally-supported R&D where the resulting technologies tend to be far from commercialization. As such, supervision from "headquarters" must be such as to ensure proper accountability, but not so heavy as to discourage active involvement by laboratory personnel.

- Second, there must be early interaction between the creators of the technology and those who understand the complexities of manufacturing and marketing it. Technology developed in disregard of these practical considerations will often not benefit the public through practical application.

- Third, to bring this about there must be powerful incentives for all sides to cooperate. This is especially true for employees of public sector institutions such as our universities and federal laboratories where research is normally undertaken for broad public purposes.

The FTTA responded to these lessons. The new Act authorizes agency heads to delegate to laboratory directors the authority to enter into cooperative research and development agreements with the private sector and other entities, and to agree in advance on the rights the cooperating parties would have in any resulting inventions made by a federal employee. The employee was entitled to a guaranteed share of the royalties received by the government. The lab itself was also entitled to retain the majority share of the remaining royalties.

In addition, a mechanism was put in place designed not only to transfer federally-developed technology to the private sector but to make private sector scientific talent available to federal

researchers as well, thus making the flow of information a two-way street and increasing the skills and expertise of all participants.

Thus, the key principles of decentralization of technology management, federal-private sector interaction, and suitable incentives were all satisfied in the new statute.

The Act did not specify exactly how it was to be implemented. Even the FTTA's most enthusiastic supporters knew that it would take time to change a culture that had existed for so long. President Reagan ended any lingering debate over how the law would be applied by issuing Executive Order 12591 on April 10, 1987. The President instructed the agencies to delegate authorities to their laboratory directors to implement the Federal Technology Transfer Act.

3. The Relationship of the Laboratory to its Parent

Decentralization of technology management is a central feature of the Federal Technology Transfer Act. Consistent with the principle that those who understand a developing technology best are those who created it, the Act encourages agency heads to make appropriate delegations to laboratory directors instead of retaining such authorities at headquarters, except as necessary to satisfy legitimate oversight needs.

In providing for a decentralized approach, the FTTA implicitly reflected a concern of the 1983 Report of the White House Science Council's Federal Laboratory Review Panel which had deplored the tendency of some agencies to micromanage their laboratories. The commission had emphasized that "excesssively detailed direction of laboratory R&D activities from agency headquarters...has seriously impaired R&D performance in some laboratories."

A review of agency rules implementing the Act reveals that agencies have displayed considerable sensitivity to the need to decentralize and to reduce the administrative burden on individual laboratories. All recognize that the point at which "the rubber meets the road" - where the heart of an agreement is developed - is the point at which contact between industry representatives and federal scientists occurs.

Most have made efforts to delegate authority to enter into agreements, subject to appropriate higher level review, to the smallest practical unit that can realistically be called a laboratory, which is defined in the Act as "a facility or group of facilities." But because of differences in agency missions, structures and traditions, different approaches have been taken toward decentralization.

For example, within the Department of Commerce, authority has been delegated to the Director of the National Institute of Standards and Technology (NIST), formerly the National Bureau of

Standards, for all arrangements within the scope of that organization's program responsibility. The Director has in turn delegated the authority to the directors of NIST's major laboratories: the National Engineering Laboratory, the National Measurement Laboratory, the Institute for Materials Science and Engineering, and the National Computer Systems Laboratory.

The National Oceanic and Atmospheric Administration, also at Commerce, has delegated authorities to five laboratories and three Assistant Administrators for research services.

The Department of Agriculture, on the other hand, has delegated authority to the Agricultural Research Service which, unlike NIST or NOAA, has chosen to treat itself as a single laboratory. To some degree, USDA's decision is rooted in practical considerations: it has 120 field locations, many of which are two- and three-scientist operations. USDA's approach is intended to ensure that these smaller operations receive encouragement and administrative support.

On the other hand, some of ARS's facilities have over 200 scientists. Accordingly, ARS and other organizations with similar arrangements must nurture decentralized technology management by the larger, more capable facilities while assisting their smaller, less capable components.

The Environmental Protection Agency has defined laboratories broadly so that it can apply to very small operations and even to those not normally considered to be laboratories in the layman's use of that term, such as its Policy Office. EPA's view is that even its Policy Staff develops computer models and that such models eventually may have commercial applications.

Given different agency needs and organizational charts, we cannot conclude that there is one "right" way. In future reports, the Commerce Department will address how particular delegation modes are working. Right now it is simply too soon to tell.

Although NASA is using the authorities of the FTTA as the basis for sharing royalties with its inventors, it has chosen to continue its centralized technology management system based on the authorities of the Space Act.

The Space Act, unlike the FTTA, (a) permits the agency to commit federal funds to cooperative ventures and (b) provides for greater centralization of authority, which NASA believes is more appropriate for its needs. NASA also has a long history of working with the private sector under this law. In future reports we will compare NASA's record with respect to the number of cooperative agreements with industry, royalties returned to the agency, number of inventions reported by its laboratories, and any other relevant factors, with the records of other agencies relying on the FTTA.

In the final analysis, however, the success of the FTTA depends

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less on the degree of freedom that laboratories have to enter into cooperative arrangements than it does on the respect which private firms have for the laboratories, their knowledge about laboratory capabilities, and their perception that these capabilities are consistent with their own needs.

It is here that the agency headquarters have a major role to play. The previously cited 1983 White House Science Council's report in reviewing agency-laboratory relations, complained that many laboratories had only ill-defined missions or obsolete missions and that "in most cases, the agencies' oversight means an excessive amount of reporting and paperwork, but inadequate scrutiny of the quality and relevance of the laboratories' activities." The Commission was concerned that a laboratory would confuse its mission with its preservation.

The FTTA recognized the importance of a clearly stated mission by (a) requiring each agency to make separate determinations of the mission or missions of each of its laboratories, and (b) making technology transfer a laboratory responsibility, to the extent consistent with its mission responsibility. Some of these facilities, such as those concerned with national security or national defense, have missions that are likely to result in only limited opportunities for pursuing private sector responsibilities. But for those whose missions are less clear, the degree or absence of private sector interest may be a useful indicator as to whether that facility's charter warrants reexamination.

The Department notes that the establishment of research advisory committees, such as those of USDA and NIST, could be important devices for agency use in ensuring that their R&D has practical applications.

4. Cooperative Agreements Under the Act

The Department of Commerce estimated that, as of the close of FY 1988, federal agencies had concluded, or were in the final stages of negotiating, approximately 111 cooperative agreements within the meaning of the FTTA. Many of these are based on a model agreement which was developed by Commerce's Office of Federal Technology Management and modified by individual agencies to meet their specific needs.

These included agreements involving the Department of Agriculture (39), the Department of Health and Human Services (29), the Department of the Air Force (17), the Department of Commerce (10), the Department of the Army (7), the Department of the Interior (6), the Department of Veterans Affairs (2) and the Environmental Protection Agency (1). Agreements in fairly early stages of negotiation are not reflected in the above figures.

A number of points should be kept in mind in evaluating these figures. First, the pace is clearly accelerating. NIH, a part

of HHS, has informally advised us that it is now processing approximately 5 proposed R&D agreements each month. As such, the numbers for FY 1989 should be much higher. NIST, in the Department of Commmerce, has advised us that in the few months since the close of FY 1988, its agreements have almost tripled from the 10 noted above to 28.

Second, some agencies do enter into agreements similar to those described in the FTTA but rely on other authorities. NASA is a notable case. To the extent that they do so, the figures above are lower than they might otherwise be.

Third, some agencies perform much of their research through facilities other than GOGOs, such as DOE's contractor-operated facilities, and this research has commercial potential in areas ranging from solar energy to superconductivity. Such activities in support of technology transfer are not reflected in the above figures.

Fourth, agency use of the FTTA does not necessarily mean that the cooperation is "new" - i.e., that it would not have taken place in its absence. Many agencies have long and rich histories of cooperation with the private sector, state and local governments, and academic institutions. The Forest Service's record goes back to its establishment more than a century ago. NIST representatives have advised us that much of the research covered by its ten agreements might have occurred anyway, but that the FTTA is often a better vehicle for establishing these cooperative relationships.

Fifth, simply counting numbers misses the importance of vital new relationships formed under the Act such as USDA's Peoria, Illinois Biotechnology Consortium. This noteworthy project combines the resources of the USDA's Northern Regional Research Center, the University of Illinois, six private companies contributing $1 million each, the State of Illinois (which is investing $4 million), and the city of Peoria. This type of highly promising cooperation fulfills the promise of the the Federal Technology Transfer Act and would be impossible without its sensitivity to the proprietary interests and motivations of the private sector.

Other notable examples of initiatives inspired by the FTTA include the following:

- In October 1988 HHS held its first NIH and ADAMHA-Industry Collaboration Forum which was attended by more than 250 representatives of leading pharmaceutical and biotechnology companies. The forum provided a means by which those representatives could meet directly with individual NIH and ADAMHA scientists to discuss potential cooperative research.

- The U.S. Army's Electronics Technology and Devices Laboratory developed a formal, comprehensive, well-focused

procedure for implementing the Act which includes establishment of teams in specific technology areas, careful definition of objectives and responsibilities of each player, methods for developing statements of work for the research project, customization of model agreements and attendant legal reviews - all of which make it easier to obtain necessary approvals from higher authority. In short, ETDL appears to be striving to make the process routine while treating each agreement as a unique case.

- The Environmental Protection Agency has institutionalized the FTTA by forming an Office of Technology Transfer and Regulatory Support within its Office of Research and Development and has also established a Technology Transfer Advisory Committee to ensure that technology transfer issues are factored into program planning at its earliest stages.

- The Army's Corps of Engineers, by combining the intellectual property provisions of the FTTA with certain cost-sharing authority vested in it by the Water Resources Development Act of 1988 (P.L. 100-676), has developed a foundation for its new Construction Productivity Advancement Research (CPAR) Program. This initiative is designed to improve the applied research base that is available to the U.S. construction industry - an industry that has traditionally invested little in R&D.

- The Department of Energy has similarly combined FTTA-type concepts with other authorities as the basis of its Clean Coal Technology Project, a joint government-industry effort to demonstrate a new generation of environmentally clean, highly efficient coal technologies.

Some tentative conclusions regarding use of the law can be drawn:

- First, many agency officials are of the view that the FTTA is more than "business as usual" and that a good number of the agreements represent research and cooperation that would not have otherwise taken place -- illustrated most dramatically in the Peoria Biotechnology Consortium. Representatives of the Army, Health and Human Services, and USDA's Agricultural ResearchService were especially convinced of this. For future reports, the Department will closely watch for new relationships with the private sector that are forming because of the FTTA.

- Second, officals of other agencies that believe the research would have taken place anyway note that the FTTA provides a better basis for undertaking it than was previously available to them.

- Finally, most personnel believe that the Act has greatly stimulated agency personnel to think creatively in terms of technology transfer. That is discussed more fully in the

next section.

5. Impact on Laboratory Personnel

Federal scientists have traditionally had little reason to delay publication of their research, even though the disclosure of an invention in a printed publication before a patent application is filed destroys patentability in those countries that, unlike the United States, have no grace period that permits patenting within a specified period following publication. Most nations have no such provision.

As the White House Science Council reported more than five years ago - and as the Navy Department's experience confirms - many federal scientists rightly take great satisfaction from being able to advance scientific knowledge through publication of research results. Traditionally many federal scientists have viewed the private sector as an awkward partner with a different value system, and have published their findings even when this would prevent a patent from issuing.

The Federal Technology Transfer Act addressed this problem by creating important rewards for successful technology transfers for federal scientists and their laboratories. The FTTA directs agencies to pay the inventors at least 15% of any royalties their invention might bring in, and by allows the laboratories to share in the royalty stream as well. (Although the FTTA also permits agencies to develop alternative inventor incentive plans, all agencies have opted for the automatic royalty sharing plan.)

Thus, F&D funding under the FTTA has two vital goals: the traditional one of advancing scientific knowledge, and an important new element of seeking commercial applications for resulting discoveries.

A review of agency experience to date permits certain observations:

a. Increase in Number of Reported Inventions

The widespread publication of information about the possibility of receiving royalties and the growing commitment of agencies to the principles of technology transfer appears to have contributed to the remarkable upsurge in the number of reported inventions by federal scientists during FY 1988, the first full fiscal year since enactment of the FTTA.

In FY 1987, the Department of Agriculture reported 76 inventions; in FY 1988 this figure had increased to 139. The Army reported 309 inventions in FY 1987; this figure was up by almost 40% in FY 1988 to 424. The Navy, where the tendency to publish had been particularly strong, saw its reported inventions increase by more than a third - from 336 in FY 1987 to 463 in FY 1988.

HHS figures, reported on a calendar basis, reveal that the number of inventions (133) reported during the first nine months of 1988 approximated the number (132) reported for all of CY 1987, a figure which itself represented an increase of almost a fourth over the number (109) reported in CY 1986.

This bodes very well for the impact of the Act. A similar jump in invention disclosures at the universities was the first sign of the impact of the Bayh-Dole Act. In 1976 there were about 230 patents issued to universities. By 1986 the number had tripled to about 700, increasing to 900 in 1987. Particularly striking is that this sharp increase in university patenting and invention reporting by federal scientists is occurring at a time when U.S. patent rates have levelled off or have declined for other sectors. Discussions with federal officials suggest that this increase in federal invention activity is likely to have real commercial significance, rather than leading to "paper" patents. This is an encouraging sign that U.S. creative activity is alive and well in our public sector and underscores the wisdom of President Lincoln's observation as to the importance of adding "the fuel of interest to the fires of genius."

Today, universities are becoming engines for economic development because of their successful technology transfers. High technology centers across the United States are forming around them. Future reports will closely monitor whether the federal laboratories are following this heartening example.

b. Diversity of Plans

The agencies have shown remarkable resourcefulness in devising royalty payment plans to suit their individual needs. Many recognize that inventions may bring in relatively modest dollar amounts and, to ensure some meaningful return, allow inventors to keep higher percentages of the first dollars that come back to the agency.

The military services, for example, will allow their inventors to keep 20% or the first $1000, whichever is greater. Within HHS, the National Institutes of Health, the Centers for Disease Control, and the Alcohol, Drug Abuse and Mental Health Administration allow their inventors to keep 25% of the first $50,000 in royalties, 20% of the next $50,000 and 15% of any additional royalties.

The Food and Drug Administration, also within HHS, takes the opposite approach. Greater percentages of the first dollars are retained by the agency. The FDA allows its inventors to keep 15% until program costs are recovered and 35% of any additional royalties. EPA allows its inventors to keep a flat 35% of all royalties.

Congress evidently recognized that agencies would take different approaches and encouraged experimentation. It directed the Comptroller General to report to it on the efficacy of different

plans in 1991, thus giving agencies a chance to experiment and to alter their programs, if appropriate.

Accordingly, the Commerce Department will withhold further comment at this time except (a) to note that such differences do exist, (b) to express the hope that GAO's report will also discuss the experiences of agencies, such as NASA, which prefer to rely on authorities other than the FTTA, and (c) to assure the Congress that the Commerce Department will also monitor these various plans.

c. Royalties to Date

Although interest is high and implementation plans are in effect, the agreements under the FTTA are too new to have generated any significant royalty income.

However, data from the Department of Energy and the National Technical Information Service provide some useful insights.

In 1980 Congress enacted legislation which, as discussed earlier, allowed certain federal contractors to own and license inventions made with federal funding. This law applied to many of DOE's contractor-operated facilities. The remaining DOE contractor-operated facilities received ownership on a case-by-case basis under other authority. All of these facilities, however, established royalty sharing programs with their employed inventors.

In 1981, DOE's contractor-operated laboratories received $14,000 in royalties. In FY 1985, these royalties had increased to $144,000 and in FY 1987 they stood at $297,000. For FY 1988 the figure reached $584,000.

Preliminary data from the National Technical Information Service (NTIS) suggest the same trend is beginning for federally-owned and -operated laboratories. NTIS, even prior to enactment of the FTTA, licensed federally owned patents for royalties or other consideration under the provisions of Section 207 of Title 35. It also paid inventors a share of resulting royalties, but its authority to do so was uncertain. The FTTA made it clear that inventors were entitled to a share of royalties under either a cooperative R&D agreement or the Government's "207" program.

For FY 1985, NTIS collected $1.5 million in royalties in connection with 146 federally owned inventions and paid out approximately $69,000 to inventors. For FY 1988, by which time federal scientists became more aware of the possibility that they could profit from their inventions and legal confusion had been resolved, royalty payments had increased almost fourfold to $5.6 million, the number of inventions increased by almost 40% to 201, and awards to inventors amounted to $356,200.

These results have been achieved in a manner consistent with the objective of preserving the free flow of information. As noted

earlier, we have already seen a dramatic increase in the number of reported inventions at universities without any corresponding decrease in the number of scholarly publications. At most, there has been short-term publication delay to afford the laboratory an opportunity to decide if a patent should be sought. Indeed, universities are generally seeing an increase in both patenting and publishing rates, including a striking increase in co-authored university-industry publications in the decade following enactment of Bayh-Dole.

In short, if the experience of the universities and NTIS is any guide, a fair program of royalty sharing, when coupled with support and encouragement by laboratory managers and the parent agencies, should yield steady progress.

6. International Considerations

The ultimate aim of all federal technology transfer initiatives is, as indicated in Section 2, to promote the ability of U.S. firms to compete in world markets. U.S. taxpayers contribute more than $63 billion each year to federal R&D initiatives. To the extent that this investment can yield new products, new processes, new industries and new jobs, those taxpayers ought to be the principal beneficiaries.

In the Bayh-Dole Act, Congress prohibited not-for-profit contractors electing to take title to federally financed inventions from giving exclusive licenses to firms that did not agree to manufacture the invention in this country - except to the extent that domestic manufacture was impractical or efforts to find licensees that would agree to such terms proved unsuccessful.

During the 1980's, as concern about U.S. competitiveness began to mount, this emphasis on domestic manufacture as a means of protecting the taxpayers' investment was seen as insufficient. Focus shifted from the relatively narrow issue of where a particular invention might be used or manufactured to the broader question of whether the taxpayer-financed technology on which the products of tomorrow might be based was being given away without receiving an adequate quid pro quo, particularly as other nations demonstrated an adroitness at turning basic research into products for the marketplace.

It has long been evident that our foreign competitors routinely scour our public R&D institutions looking for technology leads. Historically the United States has been by far the leader in conducting - but not necessarily commercializing - basic research. Countries such as Japan are redoubling their efforts to close the basic research gap.

Thus, the drafters of the Federal Technology Transfer Act were concerned that the advantages of entering into cooperative research arrangements with federal laboratories not be extended

to participants from foreign countries that deny U.S. entities the right to enter into similar ventures. The Act required laboratory directors to consider such practices when deciding which proposals to pursue.

Since then there have been a number of other instances in which Congress and the Executive branch have expressed their determination that the United States receive an appropriate quid pro quo before making its technology available to foreign entities whose governments fail to protect our interests or discriminate against us.

In Executive Order No. 12591, President Reagan expanded upon that principle by requiring laboratory directors to consider also the extent to which the relevant foreign government protects intellectual property. Subsequently, in the Omnibus Trade and Competitiveness Act of 1988, Congress required that federally supported international science and technology agreements be negotiated so as to ensure: 1. that the United States enjoys similar access to the research facilities of the other countries as we grant here (i.e., the agreement should ensure "symmetrical access"); and 2. that the other ~~country~~ provides proper protection for intellectual property. It also required that proposed science and technology agreements be reviewed for their consistency with the principles of the Bayh-Dole Act and the Federal Technology Transfer Act.

In short, the requirements of the FTTA should not be viewed in isolation but as part of broader, evolving policies aimed at encouraging agencies to exercise greater discretion with respect to, and control over, commercially valuable, federally financed technology.

In consultation with the various agencies, an informal system has been devised whereby laboratories will simply notify the Department of Commerce when they have identified a party proposing an agreement as being foreign controlled and the Department will consult with the United States Trade Representative. The laboratories then will be advised as to whether the home country's protection of intellectual property is adequate and whether there is any evidence that it denies U.S. firms the right to enter into similar agreements or otherwise precludes their access to its research facilities.

It should be noted, however, that Congress has not provided agencies with much guidance for determining what is meant by "foreign controlled." However, Congress recently defined the concept in the "Buy American Act of 1988" (see Title VII of P.L. 100-418) and the Department and USTR are considering the extent to which these standards can be adapted for use by agencies in implementing the FTTA.

The Department of Commerce published a request in the Federal Register in April 1988 for information from the public concerning denial of access to foreign research facilities. It followed up

with press releases, letters to private firms and calls to trade associations to urge them to bring the request to the attention of their members. To date, the Department has received some information as to potential problems but no specific, identifiable cases of governmentally-imposed barriers to U.S. participation in foreign R&D programs.

This response is not surprising given that the concept of conducting R&D with foreign research institutions is generally new to American industry. U.S. firms, until recently, have shown only limited interest in working with federal facilities, much less with those operated by foreign governments. Many domestic companies are skeptical as to whether invitations from foreign entities to enter into such agreements are made in good faith or are attempts to tap into our existing technology base. These views may change with the increased internationalization of science and technology.

The Department of Commerce will continue to monitor this situation so that it can advise federal laboratory directors when barriers are encountered in specific countries. It is currently participating in an interagency task force chaired by the National Science Foundation which is aimed at developing concepts for measuring the symmetricality of access in the context of the recently-concluded U.S.-Japan Science and Technology Agreement. The Committee's work should be useful in reviewing U.S. access in other situations.

Congress' concern that agencies be sensitive to these various international considerations is not surprising. Foreign nations have been remarkably adept at identifying the sources of valuable technology in the United States that will lead to new products. The extent of foreign participation in federal laboratory research was recently documented in an August 1988 report by the General Accounting Office entitled "U.S. and Foreign Participation in R&D at Federal Laboratories" (GAO/RCED-88-203BR).

It would be ironic if these foreign firms prove themselves to be more farsighted in identifying opportunities for cooperation with federal facilities - and in reaping the attendant technological advantages - than our own domestic companies. As GAO's Report found, given staffing and space constraints that limit the number of outside researchers who can conduct R&D at federal laboratories, "the best way to control foreign participation is to stimulate U.S. participation." (Id., p. 52).

Accordingly, even though the relative newness of the FTTA and the small number of agreements entered into thus far permit no conclusions to be drawn, it will be necessary to monitor the relative degree of foreign versus domestic interest in entering into collaborative arrangements under the FTTA.

7. Statutory and Other Problems

a. Computer Software

Because copyright law prohibits federal employees from obtaining copyright protection for works created in the course of their official duties, the incentives of proprietary protection and royalty sharing - so vital in the case of inventions - are unavailable to spur the development of computer software that for legal or practical reasons cannot be patented. Such software can have substantial commercial value.

DOE's GOCOs are not subject to this prohibition and their experience reveals just how important proprietary rights can be as a spur to the commercialization of software developed in connection with federal programs. A good example is DOE's encouragement of an Oak Ridge National Laboratory consortium. This consortium is a cooperative agreement between twelve sponsoring companies who are co-funding the development of user friendly and intelligent software systems for more easily accessing a highly complex set of finite element analysis models.

GOGO research should yield equally satisfying results. The Department of Defense, for example, expends considerable effort in developing computer-based vocational training materials which may have significant commercial value for a wide range of vocations and disciplines.

The Agriculture Department noted that virtually none of the cooperative agreements signed or under negotiation dealt with expert systems, artificial intelligence or other forms of knowledge engineering, even though the systems approach and software-derived technology reflected a growing portion of its research. Indeed, USDA also noted that this problem antedated the FTTA and that the government's inability to provide software protection had been a major factor in its inability to interest the private sector in its activities in such fields as crop production, forage-livestock interaction, and food processing-quality interaction.

It thus appears that the absence of an ability to convey proprietary rights might result in the loss of significant opportunities for federal-private sector cooperation in areas of significant commercial potential.

Merely making software available without proprietary protection, may be insufficient to ensure its effective commercialization. Much of today's software is complex, containing thousands of lines of code. It is often useless to businesses unless they are willing to make substantial investments of time and money. For software to be commercially valuable, it has to be debugged, simplified and customized and training manuals must be available as well. Without an appropriate license, a firm could not be assured of recouping the necessary investment in providing such services.

Simply stated, the plain fact is that without an appropriate policy dealing with the commercialization of federally-developed software, the prospects for its development and commercialization will probably be limited.

The drafters of the FTTA were certainly aware of this. The legislation specifically required the Commerce Department to study the issue and make appropriate recommendations. In May 1988 then Secretary of Commerce C. William Verity submitted the required report recommending corrective legislation; at about the same time, the General Accounting Office issued a report to Congress (GAO/RCED-88-116BR) which also noted that the absence of copyright protection for computer software was perceived by laboratory and agency officials as a technology transfer constraint.

The Department of Commerce, in consultation with other agencies, is developing suggestions for legislation that could be reviewed by the Administration. The Department and agencies will also consider the question of whether a similar limitation on the ability of federal scientists to obtain protection for semiconductor chip mask works should also be lifted. Such works are not protected by copyright but, rather, receive a sui generis form of protection under Title 17. Nevertheless, the same limitation applies.

b. Freedom of Information Act

One major incentive for the establishment of cooperative relations between a private firm and the government is the existence of an expensive or unique research facility where federal scientists and scientists employed by a firm can work "shoulder to shoulder" on proprietary research. But, as GAO's March 1988 report found, the opportunities for this are limited at least in part by the government's inability to assure the firm that the results will not be made public to its foreign or domestic competitors under the Freedom of Information Act (FOIA). The experience of the federal laboratories since that report was issued confirms GAO's earlier finding. Many agencies reported that protection of proprietary information was one of the first issues raised by potential R&D partners. The frequency and regularity with which the issue is raised to laboratories by the private sector suggests that such concerns may have deterred many firms from seeking cooperative arrangements with federal institutions in the first place.

Accordingly, the Department will continue to work with agencies to determine the extent to which FOIA may impede the negotiation of advantageous cooperative research and development agreements. Laboratory officials have informally advised the Department that they believe that the objectives of FOIA, the goal of preserving open scientific communication, and the proprietary interests of sponsoring partners can be balanced by offering the sponsoring partner a limited period of exclusivity after which the information would be subject to disclosure under FOIA.

c. Personnel Matters

Personnel in federal laboratories often do not have the knowledge and skills essential for effectively negotiating complex agreements with the private sector. This limitation could undermine the FTTA's basic objective of encouraging the laboratories themselves to take an active role in promoting the transfer of federally funded technology.

Accordingly, it would be helpful to consider methods that could be used to improve the skills of technology managers and scientists in negotiating agreements with the private sector.

Several agencies also have indicated that they may be unable to hire enough patent attorneys to support their technology transfer programs. These agencies note that patent lawyers command far higher compensation in the private sector than federal agencies can hope to offer. Contracting for such services may be an available alternative. Patent counsel are essential to the process of determining patentability, drafting technical documents, and negotiating advantageous licensing arrangements. The FTTA does authorize agencies to use royalties to pay for such services. Perhaps as royalties increase this problem may be somewhat eased.

At the present time, the Department of Commerce does not believe it has sufficient data to justify any specific recommendations. However, these personnel matters warrant careful monitoring. We expect to return to it in the next biennial report.

d. Conflicts of Interest

In September 1988 the U.S. Office of Government Ethics (OGE) advised the Department of Commerce that royalty sharing under the FTTA is "a form of compensation from the Government which does not cause an employee to have a personal financial interest to which the conflict of interest laws are applicable." OGE noted that under the statutory scheme, a federal employee is not placed into a direct relationship with the party paying royalty fees.

However, agency employees remain bound by the statutory provision (18 USC 207) that bars a former federal employee from representing another person before an agency on matters that the ex-employee worked on while at the agency. Any matter in connection with the invention in question would appear to bring that section into play.

In addition, some agencies, while aware of OGE's opinion, believe that their particular mission may obligate them to impose special rules. The Food and Drug Administration, for example, has expressed concern about potential conflicts that could arise when its scientists stand to profit from inventions that cannot be marketed without that agency's express approval. FDA is in the process of reviewing its regulations to ensure that its concerns are addressed without unduly limiting the ability of its

personnel to take advantage of the opportunities accorded them by the FTTA.

The Commerce Department expects shortly to issue FTTA conflict of interest guidelines to assist agencies in this area and will be pleased to work with them individually, if requested.

8. Conclusion

In summary, progress to date under the FTTA has been good.

- Agency administrative personnel understand the Act's merits and are anxious to make it even more effective.

- Laboratory personnel are becoming more and more interested in making their work useful to the private sector.

- U.S. firms are becoming increasingly aware of the Act and in many cases are finding out that the federal laboratories are conducting research that can valuable to them.

There is still work to be done, but the Act's goal of fostering a new era of scientific and technical cooperation between the public and private sectors appears well on the way to becoming a reality.

20 September 1990

Databases listed contain foreign technology. They do not indicate in the full record that the technology is available for licensing or patenting.

APIPAT 1964-	Worldwide patents relating to petroleum refining and the petrochemical industry. (Available from STN and ORBIT)
CHINESE PATENT ABSTRACTS 1985-	Chinese patent applications. (Available from DIALOG and ORBIT)
DEUTSCHE PATENT DATEN-BANK 1981-	German patents. (Available from STN)
INPADOC	Listing of worldwide patents; gives legal status. (Available from STN, DIALOG, and ORBIT)
JAPIO	Japanese patents. (Available from ORBIT)
WORLD PATENTS INDEX 1963-	International patents. (Available from DIALOG and ORBIT)
CHEMICAL ABSTRACTS 1967-	Worldwide chemical literature. (Available from DIALOG, STN, ORBIT, BRS, DATA STAR)
PAPERCHEM 1968-	International literature of pulp, paper, and board manufacturing industries. (Available from DIALOG)
SOVIET SCIENCE AND TECHNOLOGY 1975-	Science and technology information published in Soviet Bloc countries. (Available from DIALOG)
PHARMAPROJECTS	Pharmaceutical products under development worldwide. (Available from BRS, DATA STAR, STN)
ENGINEERING INDEX 1970-	Worldwide engineering and technological index. (Available from BRS, DATA STAR, DIALOG, ORBIT, STN)
NTIS 1964-	Government-sponsored research and development. (Available from BRS, DATA STAR, DIALOG, ORBIT, STN)
DOE 1974-	International literature on energy and related fields. (Available from DIALOG, STN)

NASA/RECON 1962-	Worldwide literature in the fields of engineering, geosciences, mathematical and computer sciences, chemistry and materials, aeronautics and physics. (Available from NASA)
AEROSPACE DATABASE 1974-	Worldwide literature related to aerospace. (Available from DIALOG)
METADEX 1966-	International literature of metallurgy. (Available from DATA STAR, DIALOG, ORBIT, STN)
AGRICOLA 1970-	Worldwide literature in agriculture and related areas. (Available from BRS, DIALOG)
APPLIED SCIENCE AND TECHNOLOGY INDEX 1983-	International literature in the applied sciences and technology. (Available from WILSONLINE)
EAST EUROPEAN CHEMICAL MONITOR 1984-	Business information from the chemical industry sector. (Available from DATA STAR)
ENGINEERED MATERIALS ABSTRACTS 1986-	World's literature on polymers, ceramics, and composites. (Available from DIALOG, ORBIT)
ICONDA 1976-	Worldwide literature on all fields of building construction, construction engineering and architecture. (Available from ORBIT, STN)
INTERNATIONAL PETROLEUM ABSTRACTS 1984-	International literature on such areas as petroleum refining and products, geology, and geophysics. (Available from ORBIT)
PETROLEUM/ENERGY BUSINESS NEWS 1975-	International coverage of the literature of petroleum and energy-related news items. (Available from DATA STAR, DIALOG, ORBIT)
PTS PROMPT 1972-	Literature on products and services of the chemical, computer, communication, energy industries, etc. (Available from BRS, DATA STAR, DIALOG)
SCISEARCH 1974-	Multidisciplinary index to the literature of science and technology. (Available from DATA STAR, DIALOG, ORBIT)
TRADE AND INDUSTRY INDEX 1981-	Trade, industry, and commerce related information. (Available from BRS, DIALOG)

INSPEC 1969-	Worldwide literature of physics, electro-technology, computer and control engineering, and information technology. (Available from BRS, DATA STAR, ORBIT, DIALOG, STN)
CURRENT TECHNOLOGY INDEX 1981-	Literature on British technology. (Available from DIALOG)
JAPINFO 1987-	Literature of the scientific and technological grey publications of Japan. (Available from DATA STAR)
JICST-E 1985-	Japanese literature on all fields of science, technology, and medicine. (Available from STN)
PASCAL 1973-	Worldwide scientific and technical literature. (Available from DIALOG)

Database

VENDORS

B – BRS
C – CFRBBS
D – DEFENSE TECHNICAL INFORMATION CENTER
DS – DATA-STAR
F – FIREDOC
G – GIDEP
I – CHEMICAL INFORMATION SYSTEMS, INC.
L – DIALOG INFORMATION SERVICES
M – MEAD DATA CENTRAL
N – NEWSNET
NASA – NASA/RECON
NLM – NATIONAL LIBRARY OF MEDICINE
O – OCLC
S – ORBIT
STN – SCIENTIFIC AND TECHNICAL INFORMATION NETWORK
V – VU/TEXT
W – WILSONLINE

BRS – BRS Information Technologies
1200 Route 7
Latham, New York 12110
(800) 345-4BRS

C – CFRBBS
Doug Walton
Center for Fire Research
National Institute of Standards and Technology
B345 Polymer Bldg.
Gaithersburg, Maryland 20899
(301) 975-6872

D – Defense Technical Information Center
Department of Defense
Bldg. 5 Cameron Station
Alexandria, Virginia 22304-6145
(202) 274-6871

DS – DATA-STAR
D-S Marketing, Incorporated
Suite 110
485 Devon Park Drive
Wayne, Pennsylvania 19087
(800) 221-7754

F – FIREDOC
Nora Jason
Fire Research Information Service
Center for Fire Research
National Institute of Standards and Technology
A252 Polymer Bldg.
Gaithersburg, Maryland 20899
(301) 975-6862

GIDEP – GIDEP Operations Center
Corona, California 91720
(714) 736-4677

I – Chemical Information Systems, Incorporated
7215 York Road
Baltimore, Maryland 21212
(301) 321-8440

L – DIALOG Information Services, Incorporated
3460 Hillview Avenue
Palo Alto, California 94304
(800) 334-2564

M – Mead Data Center
The Mead Corporation
9443 Springboro Pike
P.O. Box 933
Dayton, Ohio 45401
(800) 227-4908

N – NEWSNET Incorporated
945 Haverford Road
Bryn Mawr, Pennsylvania 19010
(800) 345-1301

NASA – NASA/RECON
NASA Scientific and Technical Information Branch
Washington, D.C. 20546
(202) 453-2017

VENDORS

NLM—MEDLARS Management Section
National Library of Medicine
Bldg. 38A, Rm. 4N421
Bethesda, Maryland 20894
(301) 496-6193

OCLC—OCLC
6565 Frantz Road
Dublin, Ohio 43017-0702
(614) 764-6000

S—Pergamon Orbit InfoLine, Incorporated
8000 West Park Drive
McLean, Virginia 22102
(800) 421-7229

STN—STN International
2540 Olentangy River Road
P.O. Box 02228
Columbus, Ohio 43202
(614) 421-3600

V—VU/TEXT Information Services, Incorporated
325 Chestnut Street, Suite 1300
Philadelphia, Pennsylvania 19106
(800) 258-8080

W—The H. W. Wilson Company
950 University Avenue
Bronx, New York 10452-9978
(800) 367-6770

JOE SHUSTER REMARKS TO
A HOUSE OF REPRESENTATIVES
COMMITTEE HEARING ON
HOUSE BILL #4659

SEPTEMBER 6, 1990

RE: NATIONAL TECHNICAL EXTENSION SERVICE

Thank you for inviting me to be with you and to share our experiences in providing a National Technology Transfer Service. I think you will come to agree that what we have learned has a great deal of relevance to your deliberations on House Bill #4659.

Smart, world-class competitors are constantly looking for leverage, and nothing today provides more economic leverage than technical knowledge - NOTHING.

If publicly-funded American research produces the most--and often the best--technology in the world, why aren't American companies doing more to exploit such know-how for competitive advantage? The answer is simple. They haven't had, and most still don't have, convenient access to this knowledge. That's particularly true of small companies. Until Teltech created a convenient infrastructure and began providing its service, it was almost impossible for companies to efficiently and reliably access needed outside technology.

Many believe that Japan's economic miracle happened because they excel in commercializing research. This is partially true, but I believe that their greatest genius is in finding relevant technologies in the first place. They do this systematically on a world-wide basis. They clearly understand that access to research is as good as doing the research--and one heck of a lot cheaper.

By comparison most American companies, and particularly small ones, don't have access to any organized technical information system. Many have never heard of a technical database. A large number don't even know where our major national laboratories are located--much less what is going on inside them. To expect these companies to remain technically competitive over time would be laughable, if it weren't so sad.

The service described in House Bill #4659 is a kind of one-stop technology shopping center in-tune with modern industry's technology needs. This bill will give American small businesses access to the best technology in the country on a day-to-day, "grass roots" basis. For the first time in history, rural and small companies will have the same access to information and technical knowledge as the nation's largest corporations.

The proposed service elements include:

1. Access to technology through new and existing databases to virtually all of the world's technical literature.

2. Access to federal, and other technical experts.

3. Access to needed marketing and competitive information through existing databases.

4. Access to other federal and state services.

The Bill anticipates the use of most of the federal databases that have already been created. Many would be usable in their present form while others would require some modifications. The Bill also calls for a standard format and front-end software that would properly integrate all the databases for ease of use.

The cornerstone of the program, however, will not be databases, but rather, human beings--immediate and direct access to experts able to respond to virtually any technical question whatsoever. Implicit in this day-to-day interaction is closer bonding between academic and federal experts and their industrial counterparts.

It is appropriate that the Bill proposes to offer the service free or on a cost sharing basis to companies with annual sales of less than $15,000,000. Small businesses create the most jobs. They are also more risk oriented, faster moving and, because of internal resource limitations, stand to benefit most from reaching outside for help. Ironically, while they have the greatest need for the kind of services called for in this legislation, they are also least able to pay. And they are much more prone to the problem of not knowing what they don't know.

Conversely, many large- and medium-sized companies across the nation are already reaping the competitive advantages of technical outreach. They subscribe to Teltech. And nowhere are their satisfaction levels, value perceptions and consequent willingness to pay for such services more evident than in the remarkable fact that each year 92% of them resubscribe.

As for the anticipated impact of this legislation, a variety of studies have documented the remarkable payback associated with technology transfer (see Figure 1).

Figure 1

Payback On Technology Transfer
Various Studies

	Benefit:Cost
DOD/DOE Study [1]	26:1
Pennsylvania State Study	17:1
Federal Survey [2]	15:1
Teltech User Study [3]	23:1
Bell Laboratories [4]	14:1

1 AGARD Study
2 Representative LaFalce, N.Y.
3 Independent Study - Brum & Anderson
4 King Study

The data is almost too spectacular to be believed. However, those of us who are in the technology transfer business can easily understand how effective use of technical information resources can literally spell the difference between business success or failure.

Incidentally, the chart shows only primary benefit. The secondary benefit of using new knowledge as a building block can also be dramatic.

My personal experience demonstrates the point. I started a company, MVE Cryogenics, in 1963, and I can tell you that one piece of timely technical assistance from a university professor saved our corporate life. Today, MVE is the world leader in its field, and employs well over a thousand people. Long-term benefit in this case is obviously very great, but also difficult to quantify.

From industry's perspective, there is no doubt that it is generally more important and useful to systematically transfer the knowledge, know-how, and technical insight learned in our many research labs than it is to transfer a piece of intellectual property once in a while.

This Bill is sensitive to everything Teltech has learned in providing a technology transfer service to a nationwide client base. For instance, we learned that:

1. To qualify as adequate, a technology transfer system must provide for day-to-day interaction between the providers and the recipients at the grass roots level. That is where the action is--where technical decisions are made. Not one in the whole litany of services mentioned by Mr. Kammer does this.

2. The service must be complete. There should be virtually no gaps in its technical coverage. Not one in the whole litany of services mentioned by Mr. Kammer, not all of them together, is this complete.

3. The service must be accessible right from the desk of each end user. Not one in the whole litany of services mentioned by Mr. Kammer provides for this necessity.

4. Effective use of a technology transfer system requires a great deal of training. Regardless of the potential benefits, U.S. industry, in many ways, is a reluctant partner, no matter what it says to the contrary. The process is definitely counter cultural. Americans have always essentially turned inward when confronted with a technical problem or need.

The good news is that once a company--large or small--is given access to a technical outreach program that is truly in-tune with its needs and sensitivities, it will take to the program with a vengeance.

Its good for us to recognize that, when it comes to technology, we are still the richest nation on earth. But we must also shoulder the critical responsibility of ensuring that this wealth is effectively shared. American companies and their scientists and engineers can no longer afford to work in corporate isolation, wrestling with problems that have been solved many times before. Or worse yet, making mistakes that others have made. Neither can we continue to justify today's myriad of under funded, incomplete, and splintered state and federal technology transfer programs that practically nobody uses and that seem to say, "Come to me if you can find me, and I'll try to help you if I can." There is no doubt that the infrastructure described in the Bill would pull many of these programs together, and substantially enhance their usefulness.

Mr. Kammer, in his testimony, said they are already mandated to accomplish what is described in this bill. So are other agencies mandated, so are many state programs mandated, but while all of them do some good, none are complete enough and they simply are not getting the job done for small business.

It seems to me that given their mandate, they (NIST) would jump at the chance to encourage a bill that would tie the myriad of splintered, incomplete services into one single integrated program that is already tested and proved. It surprised me that Mr. Kammer did not concede that even with all of the cited technology transfer programs in existance, small business still finds it almost impossible to find the technical help they so desperately need.

We always need more research into new technologies, but we don't need new research as much as we need better utilization of the technology we already have. The truth is that Japan greatly out-leverages the United States largely because of its passionate dedication to seeking out ways of accessing and disseminating technology. We, on the other hand, focus almost entirely on technology production, with practically no facility for sharing or extending what we produce.

Some concepts that make a big difference are simple, but eloquent in their simplicity. In aggressively reaching out for information that is available to everyone, Japan is merely acting on its recognition of a simple idea. They know that while basic research returns $2 for every $1 invested in a 6 to 7 year time frame, technology transfer pays back 20:1 plus, and the pay-off can often be measured in days. Over the past six years, Teltech has been a front line witness to the dawn of this same realization within American industry. I believe

the technology transfer program called for in House Bill #4659 can go a long way in restoring our formidability as a competitor on the global playing field. Where else could we find such leverage? I think nowhere -- and I would bet my life on it.

I have absolutely no doubt that the passage and implementation of this Bill will one day be considered a milestone in the continuing economic development of this country.

Thank you!

33-979 0 - 91 - 4

STATEMENT

Prepared by Mr. Leo Reddy
President, National Coalition for Advanced Manufacturing

For Hearings Held by the Committee on Small Business
United States House of Representatives
September 5, 1990

Mr. Chairman:

I am privileged to have this opportunity to appear before the Committee on Small Business in order to comment on the Technology Access Program envisaged in House Resolution 4659.

I would like to congratulate you, Mr. Chairman, as well as Congressmen Boehlert, Broomfield, and Wyden for introducing this bill. It represents a creative, innovative, and cost-effective approach to diffusing technology rapidly into the nation's industrial base. It recognizes the critical importance of technology for the nation's productivity and competitiveness. The program outlined in H.R. 4659 is conceptually sound and eminently practicable.

Above all, this bill responds to the most glaring gap in America's performance in the field of technology: getting existing, off-the-shelf technology more rapidly into the hands of industry. Our national problem in this field is not just the development of advanced technologies, but ensuring that they translate into commercially usable products at a much faster pace. This bill also recognizes that the greatest challenge in the field of technology transfer is to ensure that these technologies also reach the nation's small businesses.

My only reservation about H.R. 4659 is that it is far too modest both in its scope and its timetable. It is not commensurate with the urgency and magnitude of the problem it addresses. I recognize the value of beginning with a pilot program confined to only five states. Yet,

if our government is truly committed to strengthening this nation's position in the global marketplace, we must provide strong support to crucial programs such as the Technology Access Program proposed in H.R. 4659. While it compares itself to the successful agricultural research and extension program, there is no comparison whatsoever in terms of anticipated funding levels. H.R. 4659 contemplates $2 million for FY 1991 and $3 million for each of FY 1992, 1993, 1994, and 1995 for the pilot program and $5 million for the technical assistance program through Small Business Development Centers for each of FY 1991, 1992, and 1993. By contrast, the extension services portion alone of the $2.2 billion agricultural research and services program will be about $369 million for FY 1990.

I might add that the exemplary agricultural extension service program applies only to the diffusion of agricultural technology, while the program contemplated under H.R. 4659 would encompass all technology relevant to the nation's industries. For my part, I will address today the relevance of the Technology Access Program for the diffusion of manufacturing technologies. In making these remarks, I am reflecting the views of the broad constituency of interest--from manufacturing firms of all sizes, to centers of manufacturing research and extension, to national trade and education associations, and others--which makes up the bipartisan, non-profit National Coalition for Advanced Manufacturing.

Using manufacturing technologies as a case in point, I would like to begin by discussing the importance of transferring these technologies to America's economic competitiveness. I will then address the obstacles confronted in making this transfer successfully, especially to the nation's smaller manufacturers, who play such a vital role in America's economic strength. Finally, I would like to suggest a few

ways to improve on the program outlined in H.R. 4659.

Importance of Technology Transfer

The federal research establishment has enormous potential for assisting the nation to become more competitive in the global marketplace. Technological innovation, efficient use of process technology, quality manufacturing, and the ability to use technology to respond to rapidly changing market requirements are fundamental to economic competitiveness. A large portion of the expertise needed to develop and deploy these technologies resides in the federal establishment. About 38% of the nation's scientists and engineers are funded by the federal government, which, with a $70 billion annual R&D budget, underwrites nearly half of the nation's entire bill for research and development.

Despite recent efforts to relate the exertions of this sprawling government establishment to the nation's economic requirements, progress is lamentably slow. At a meeting of the National Coalition for Advanced Manufacturing last April, Congressman Wyden illustrated this problem by noting that the 1988 patent license revenue from the government's $70 billion annual R&D investment was only $4 million, yielding a paltry rate of return of .00005%.

The movement of technology from federal and natiional laboratories to commercially-relevant product has often been slow. For example, the transistor was widely used in military applications in the Korean War, but was not used in commercial microelectronics until the mid-1950's. A strong, Pentagon-funded program was needed to transfer numerical control technology for machine tools rapidly into the industrial base. Today, the federal establishment is funding research on a whole range of technologies

which are immediately relevant to advanced manufacturing, such as concurrent engineering, materials working lasers, artificial intelligence, robotics, technical data exchange systems, programmable automation, and flexible manufacturing systems.

These are generic, precompetitive technologies with the most profound effect on American industry. These technologies define the very means of production. They are an integral part of the product and process technologies which combine to manufacture literally everything made by industry.

The impact of these technologies on competitiveness is striking. Competitiveness in manufactured products is a direct function of the capacity of a firm to produce goods of high quality and reliability, on time, at best value, and flexibly. Flexibility has become increasingly important as standard products are giving way rapidly to customized products. As a leading industrial technology consultant, Brian Bosworth, stated in a July 1990 report to the National Governors' Association, "Customized products usually require application of sophisticated manufacturing equipment organized into sophisticated systems and operated by sophisticated personnel."

Technology alone will not respond to these new requirements of the global marketplace. Management skills, a well-trained workforce, improved tax incentives for plant modernization, lower cost of capital all play a key role. But the efficient integration of advanced manufacturing technologies into the nation's industrial base is a vital requirement. These technologies are the essential tools to achieve the levels of precision, quality, flexibility and accelerated product design cycle needed to be competitive.

Consider some very recent examples of the profound impact of advanced manufacturing technologies on manufacturing operations.

At its Paging Products Division in Boynton Beach, Florida, an advanced computer-integrated manufacturing facility, Motorola introduced computerized communications networks which enabled the plant to build new Bravo Pagers to customer order within two hours of receiving the order from corporate headquarters in Schaumberg, Illinois. This capability has enabled Motorola to beat the competition, even in Japan, for this product.

Using vision-aided robots in its Lewisville, Texas plant, to construct microwave circuit boards, Texas Instruments has reported a 20:1--2000%--gain in productivity.

These examples apply as well to small manufacturers. For example, Creative Forming, Inc., of Ripon, Wisconsin, a firm with 120 employees producing plastic containers, introduced three advanced manufacturing technologies in the mid-1980's: computer-aided design, manufacturing resource planning, and statistical quality control. In four years, this small, make-to-order facility tripled its sales to $15 million.

If these technologies could be transferred more rapidly to American industry as a whole, the results in terms of economic strength and growth would be dramatic. Nonetheless, the United States is falling well behind its leading international competitors in the adoption of advanced manufacturing technologies. The October 1988 Harvard-Carnegie Mellon survey of machine tool companies reported that, by 1987, only 11% of all machine tools in use in America were programmable, while the percentage in Japan was 40% and in Germany 50%. Trends reported by the Department of Commerce this spring showed the U.S. "losing badly" in the '90s to its leading competitors abroad in adopting flexible computer-integrated manufacturing.

A Special Problem for Small Manufacturers

Beyond the lackluster performance of U.S. manufacturers generally in adopting advanced manufacturing technologies, the adoption rate for smaller manufacturers is truly alarming. Here is a table drawn from the Bureau of the Census report, "Manufacturing Technology 1988," which graphically illustrates this problem. It shows the differences between firms of different employment size in terms of their rate of use of selected key manufacturing technologies:

TABLE

Technology	20-99 Employees	100-499 Employees	500 plus Employees
Computer aided design	29.8%	54.4%	82.6%
Flexible manufacturing cells	6.5%	16.2%	35.9%
Numerically controled machines	35.9%	50.0%	69.8%
Pick and place robots	2.7%	13.4%	43.3%
Automated sensor based inspection of final product	8.0%	17.4%	44.3%
Computers used for control on factory floor	18.9%	41.0%	68.0%

Much slower adoption rates of advanced manufacturing technologies by smaller firms are due in part, of course, to their greater difficulty obtaining investment capital, their reduced economies of scale, and an acute shortage of skilled workers. Another major factor, however, is simply information flow. Large firms have larger research staffs, better access to professional literature, and more time at conferences than do small firms.

This is a problem, not just for the small firm, but for the national economy. There are over 350,000 manufacturing establishments in the United States with fewer than 500 employees. They produce about half of the nation's goods and roughly two-thirds of the parts used by large manufacturers. Smaller firms are also a major source of innovation,

employment growth, and of critical defense components.

Despite the central importance of these smaller firms to the national economy, their troubles are mounting. Large firms are tightening their quality standards for parts and reducing the size of their supplier base. According to an October 1989 report by the Industrial Technology Institute, the productivity and earnings of smaller firms relative to those with over 500 employees has steadily declined in the 1980's, with smaller firms now lagging by roughly 30 percent. Job growth for smaller manufacturers has slowed. Large firms are increasingly turning abroad for parts and components, while foreign firms and investors are moving aggressively into the U.S. parts market.

If the United States wishes to retain a strong industrial base able to meet the requirements both of global competitiveness and national security, it must move to arrest the erosion of the position of our smaller manufacturers. Among other things, this means creating an environment in which these firms can gain more rapid and efficient access to the latest technological developments, especially advanced manufacturing technologies.

Comments on H.R. 4659

One of the most compelling arguments for the Technology Access Program envisaged in H.R. 4659 is that it is uniquely tailored to meet the needs of the small manufacturer by making the whole universe of technology available to him at or near his place of work, in a readily accessible format, on a continuing basis and at little or no cost. This program represents an ingenious use of modern data collection and information dissemination technologies to bring the latest advances in technology to the doorstep

of small as well as large firms.

This program can not, of course, do the whole job. It can not substitute for well-designed industrial extension service programs which assign expert extension agents to work directly in plants for several days or even weeks. It can not replace the need for education and training courses at local community colleges and technical schools. It can not compensate for managers who may be short-sighted or inept. It can not provide the kind of low-cost, longer term capital which American industry so urgently requires to acquire advanced technologies.

Nonetheless, this program can provide a enormous public service in accelerating the dissemination of technology. It puts into disgestible, usable form a vast sea of technical information which would otherwise never be known to the busy manager or engineer.

My principal reservation about this bill is that it is too modest in its pretensions. This committee, the Congress, the nation are deeply concerned over the relative decline in America's industrial competitiveness. The fact that the public ranks only one American car in the top ten in terms of reliability and quality is a further indication that those concerns are well justified.

To correct this situation, the nation needs bold programs which can have an early impact and which reach all corners of American industry. The Technology Access Program which your bill would establish forsees the completion of a 5-state model by fiscal year 1995. To have a national impact and to make a significant dent into the problems of American economic competitiveness and standard of living, this program should be broadened and strengthened.

For example, I would suggest the following changes in the bill as drafted.

First, I would expand the number of states participating in the pilot program from 5 to 15. This would provide a much stronger foundation for moving more rapidly to a full national program, assuming that the pilot program proves successful. A larger number of participants would also permit organizing the pilot by three to four regions. A regional approach to these issues has usually proved more effective. Regions tend to have economic structures and industries with distinctive characteristics and are often organized to work together on economic development issues.

Second, I would amplify the number of public access points for this technology by not confining it only to Small Business Development Centers. Without in anyway detracting from the key role of those centers the bill might give the Secretary of Commerce the authority designate other centers as participants in the program. In addition to the Small Business Development Centers, there are also well-established extension service programs organized by some state governments, by community colleges, by tech centers and state universities. The Secretary would need to establish criteria for their participation. For example, they should have an established program for industrial extension, well-defined mechanisms for communicating and coordinating with industry in their area, including with small manufacturers, a well-qualified staff for this purpose, and an ability to offer matching funds. Inclusion of these additional centers would also amplify the number of public access points and make the entire program that much more accessible to small business.

Third, I would increase the funding for this program at least three fold and state specifically that, if the pilot program succeeds, a substantial expansion of this program on a national scale is envisaged. I can assure you that the members of the National Coalition for Advanced Manufacturing will stand squarely behind an effort to secure more adequate funds

Finally, I would accelerate the timetable for this program. Systems for identifying experts in various fields of technology already exist and have proven their effectiveness in several states. H.R. 4659 stipulates that the pilot program will last until FY 1995, with the first evaluation by the Secretary of Commerce taking place after three years. Given the fact that the Technology Access Program would be building upon established systems and would not be starting from scratch, this schedule could safely be reduced by one year.

Conclusion

Mr. Chairman, the Technology Access Program proposed by H.R. 4659 represents a remarkable opportunity. When implemented on a national scale, this program would help reach that heretofore elusive goal: effective, timely transfer of technology from the federal establishment into the private sector. It would use the leverage of modern data collection and dissemination technology to make the knowledge of the nation's leading experts in any given technical field immediately available where it is most needed: in the hands of the plant engineer.

The benefits of this program far outweigh the cost. Indeed, the most compelling argument for this approach is the extraordinarily high return on investment. It is hard to imagine any program which could more directly and promptly improve industrial productivity, growth and competitiveness than this one.

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TESTIMONY OF

Lloyd E. Anderson
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Center for Industrial Research and Service
Iowa State University of Science and Technology
Ames, Iowa 50010

To:

House of Representatives
Committee on Small Business

Regarding:

HR 4659
A National Technical Extension Service:
Harnessing American Science for American Industry

September 5, 1990

Mr. Chairman, my name is Lloyd Anderson and I serve as Interim Director of the Center for Industrial Research and Service at Iowa State University. The Center is an industrial extension service funded by the state of Iowa. Its purpose is to provide technical and management assistance to Iowa manufacturers. Since its establishment in 1963, the Center has responded to nearly 30,000 requests from Iowa manufacturing firms.

The Center provides these types of assistance: problem solving in technical and manufacturing areas, relying heavily on faculty and other university resources for assistance; decision support by assisting firms with business plans, expansion plans, product development, equipment and process selection; technology transfer through linkages with faculty, researchers, NASA, Federal Laboratory Consortium and data base searches; information dissemination and exchange through interactive contacts with manufacturers and a quarterly newsletter that is mailed to manufacturing owners and managers; continuing education through the development of workshops and conferences.

Center personnel include a field staff of six who maintain daily contact with manufacturers through on-site visits, a central staff of 6.5 persons who function as

specialists in engineering, marketing and management, and three administrative support personnel.

I was asked to comment on the importance of technology transfer to small business, the strength of Teltech's form of technology transfer and finally how the bill might be improved.

Importance of Technology Transfer

Concerning the importance of technology transfer to small manufacturers, I would like to comment with respect to Iowa. Manufacturing in Iowa is the most important source of personal income--generating nearly three times as much as farming. Contrary to common perception, more than 70% of Iowa manufacturing is not related to agriculture. Given this degree of dependence, it is essential that Iowa manufacturers must become world class in order to compete both domestically and internationally.

In order to compete successfully, awareness of new and existing technology, technical expertise, marketing information and management techniques is critical. Of the estimated 4,100 manufacturing firms in Iowa, more than 3,100 employ less than 100 persons. Therefore, they do not have large internal staffs of specialists. In addition, many of these firms are located in rural areas where the opportunity for peer interaction is limited.

Our experience with computerized data base searches stems from our designation as a NASA Industrial Application Center. Since our participation, we have conducted more than 700 searches for manufacturing clients. These include searches for highly specific technical information, marketing information, preliminary trademark and patent searches. User evaluations indicate this service has been highly beneficial.

We believe electronic access to expertise and technical information is an essential tool for a modern technical or industrial extension service. As stated previously, this method of delivery is particularly beneficial for small and medium manufacturers. Several case examples of favorable results are contained in Attachment I.

Teltech's Method of Technology Transfer

With respect to Teltech's method of technology transfer, we believe their capabilities represent an advance in the use of data bases to efficiently match the needs of users with appropriate expertise and information. Teltech's strengths include access to experts, as well as to technical literature, expanded data bases and an effort to make the system more user friendly.

Suggestions to Improve Bill

These are our suggestions that in our opinion would improve the bill.

HR 4659 would be strengthened if existing data base programs could be consolidated into a single Federal effort. NASA experience could be very valuable to a new and enhanced technical extension program.

. We suggest that existing state industrial extension programs that are not a part of the Small Business Development Center program be allowed to apply for grants to be used to increase access of small manufacturers to on-line data bases. This would be similar to the provisions regarding the Small Business Development Center Technical Assistance Program.

. Finally, we believe that the time is proper to establish a permanent Federal/State Cooperative Technical or Industrial Extension Service.

Need for a Federal/State Cooperative Technical/Industrial Extension Service

Within the last twelve months, three studies have been published which examined in-depth existing Federal, State and European industrial/technical extension efforts. The studies were performed for the National Governors Association, the Economic Policy Institute and the Economic Development Administration. (A brief summary of each of the studies is included in Attachment II).

The studies of Federal and State programs indicated that the existing industrial/technical extension services have

generated substantial economic benefits, but their effectiveness is hampered by lack of funding. Because the studies have already profiled successful industrial/technical extension models, we do not believe it is necessary to embark on yet another pilot study.

There is a vital need for an adequately funded industrial/technical extension service. As indicated earlier, small manufacturers must become world class to survive. Product life cycles are shrinking, manufacturing processes and methods are undergoing rapid change and international competition is intensifying. European and Pacific rim nations are making major commitments in assisting their small and medium-sized manufacturers. Without a similar commitment, our small and medium-sized manufacturers will be at a serious disadvantage.

Each of the studies emphasized the need for ongoing interactive contact with manufacturers on their premises as a key factor in successful industrial/technical extension services. This has certainly been our experience. Whereas electronic access to data bases is an increasingly important tool in technology transfer, professional assistance is required to help clients identify problems and needs, formulate inquiries, and finally, to assist clients in acting on the information that is provided.

It is our belief that a Federal/State Cooperative Industrial/Technical Extension Service should be established in order to substantially increase our industrial outreach capabilities, that it be permanently funded and that emphasis be placed on assisting existing small and medium-sized manufacturers.

Attachment I. Case Examples

Since the Center for Industrial Research and Service began its association with the NASA Industrial Application Center Affiliate Program, more than 700 data searches have been conducted. These are examples:

Technical Information: Process for manufacturing high quality sandpaper; New water pump design; Nuclear storage battery; Shielded bearing design; Solar powered signals; Strength of glass.

Marketing Information: Home appliances; Industrial process control.

Preliminary Patent Searches: Agricultural equipment; Padded covers for medical examining table; Vending machine.

Trademark Areas: Agricultural equipment; Games; Jewelry design; Telephone company services.

Results:

. A firm located in a small community that manufacturers waste recycling trailers has made several requests for CIRAS assistance. Verl Anders, a CIRAS field staff member for Northeast Iowa, assisted the firm with a preliminary patent data base search. Several months later, the company president provided comments about the search: (Our firm) "was able to enhance our relations with a major customer because of added expertise. We avoided costs in chasing ideas already patented. We can now check information previously unavailable to small companies such as ours. This makes us much more professional and competitive. Mr. Anders did an excellent job in every respect, and the service he provided exceeded my expectations. CIRAS made a small Iowa manufacturer look good to a major out-of-state customer because we had current information available promptly. This helped us maintain contracts worth over $500,000 annually."

A firm manufacturing plastic tubing contacted CIRAS about two production problems. In the firm's manufacturing process, the inside wall of the tubing frequently became rough or wavy. In addition, the firm was having difficulty producing uniform color in the process of mixing color with the raw material. To provide assistance, CIRAS used several approaches to help solve the problems. A NASA data search was conducted to obtain abstracts of relevant information. In addition, a NASA technical search was requested to obtain additional information. At the same time, CIRAS industrial engineers discussed the possibilities with ISU professors and one of firm's engineers. Next the CIRAS engineers visited the firm's manufacturing plant to review the process and assist in running tests. The tests suggested that fluid wave motion was producing the problems. The firm has reported initial success in reducing some of the roughness in the tubing. Both the NASA search and CIRAS have suggested names of consultants that could provide additional assistance with the problems.

- A fabricated wood millwork firm wanted to obtain information on an inorganic metallic dust coating developed by NASA and determine the availability for licensing it. The NASA Industrial Application Center at the University of Southern California was contacted. They found reports and abstracts on the metallic dust and said the material was available for license through the Goddard Space Flight Center, Greenbelt, Maryland. This information was sent by FAX to the client. The firm has now obtained samples from a NASA licensed vendor and are evaluating the material.

- This animal products firm requested an interactive data search to obtain medical information on several technical topics. Numerous citations were obtained. The client requested that they be printed off-line and sent direct to him so he could obtain those particular ones of most interest. The firm also requested an overview on computer networking arrangements. Following the search, two CIRAS staff members discussed the possible systems with a member of the firm. Alternatives were suggested for the firm to consider.

- An individual requested a trademark search prior to naming a new business. Both Federal and State data bases were searched on Dialog for three possible terms. Claims were found for two of the terms; however, no claims were found for the third term. The client was sent the results of the search along with information on how to file Federal and State trademarks.

- Research and development company studying cogeneration projects needed information on greenhouse production and markets for hydroponic vegetables, bedding plants and plugs. Conferred with Horticulture Department and set up and conducted an interactive data search with the client.

Attachment II. Study Summaries

Promoting Technological Excellence: The Role of State and Federal Extension Activities. Marianne K. Clarke and Eric N. Dobson. National Governors Association.

. The firms being assisted by Federal and State-supported organizations are overwhelmingly small businesses. Sixty percent have fewer than 50 employees; another 23 percent have 50 to 500 employees.

Small and medium-sized businesses require access primarily to existing off-the-shelf technology rather than to advanced state-of-the-art technology. However, both State and Federal governments have concentrated their efforts on the diffusion of advanced state-of-the-art technology.

While state technology extension services differ substantially in structure, funding, and approach, they share some general principles:

. The programs emphasize client-directed problem solving rather than pushing out new technology.

. The program managers recognize that it is difficult, if not impossible, to separate businesses' needs for different types of assistance.

. The programs emphasize the value of on-site personal field service in aiding firms.

. Extension staff must have the ability to call on a wide range of specialists and people with particular technical expertise.

. Training is a critical component of technology deployment.

Recommendations:

. Both State and Federal governments should increase their emphasis on improving and diffusing proven manufacturing technologies.

. Any Federal effort to support technology extension activities should recognize and encourage the varied approaches being tried in the states.

. Federal and State programs to support technology extension should consider ways to provide training as an element of the services provided.

Modernizing Manufacturing, New Policies to Build Industrial Extension Services. Economic Policy Institute. Philip Shapiro.

. In successful programs which solve substantive problems, there seems to be no substitute for highly-trained, active, one-to-one field service assistance. Small and medium-sized companies respond well to "soft" and well-proved technologies rather than hardware solutions of leading-edge technologies.

. About 70% of the money spent by the states go to technology research centers and research grants. Generally these efforts do little to assist existing small manufacturers. About two-thirds of those assisted by these programs are non-manufacturers.

- Industrial extension needs a long-term commitment to develop the confidence of the industrial community and to attract and retain first-rate technical staff.

Best Practices in European Innovation Development, (Executive Summary). U.S. Department of Commerce, Economic Development Administration. Diane Palmintera, Innovation Associate.

- Small and medium-sized entrepreneur/industries are major employers in Europe--their growth and modernization seen as critical to European economies. European programs focus on them.
- Emphasis is on modernizing existing small firms rather than developing new enterprises. Fundamental difference from most U.S. programs which focus on entrepreneurial development.
- Market-driven technology development. Substantial emphasis on "technology pull" or market-driven R & D throughout Europe. All major institutes perform market research to help shape R & D and technical assistance activities. Institutes provide extensive outreach and work closely with firms to determine present and anticipated needs.
- Focus on applying existing technologies in diverse and innovative ways, rather than developing state-of-the-art technologies.
- Increasing emphasis on interdisciplinary cooperation.

WCI

20 August, 1990

Mr Bill Berkland
c/o C.I.R.A.S
I S U Research Park, Suite 501
2501 North Loop Drive
Ames, IA 50010

Dear Bill:

As discussed by phone recently, I am writing this letter to provide you with some facts for the C.I.R.A.S Newsletter.

W.C.I. Laundry Division completed a $75,000,000 addition to its Webster City, Iowa plant in 1989, introducing two new home laundry appliances to its local production. It is now an opportune time for W.C.I. Laundry Division to critically review its product development and launch system. C.I.R.A.S. has played an important role in this by making available to us the N.A.S.A. data bases. We used these data bases to conduct a series of literature searches to provide us with a look at state-of the-art product development systems in public and private sectors worldwide. This research provided a critical base for our other efforts in this project.

As always, it is a pleasure to work with you, and other members of the C.I.R.A.S. and N.A.S.A. team.

Sincerely,

Robert E. Oliver
Manager - Product Planning

Abstract

THE IMPROVEMENT OF TECHNOLOGY TRANSFER FROM GOVERNMENT LABORATORIES TO INDUSTRY

Joseph W. Lee, D.Sc.

To date, there exists a lack of useful information as feedback to Congress and the Executive Branch about how to improve the government-industry technology transfer process. Industry responses and attitudes regarding technology transfer policies have been neglected because researchers were focusing on theoretical models, cumbersome procedures, narrow-focus case studies and the obsession for commercial payoff analyses. Commercialization success, defined in terms of economic gain and job creation, can be difficult to quantify due to the lack of standardized evaluation procedures. This situation is complicated by the strategic impact of technology (the long term effect on business and society) and other influencing variables such as management effectiveness and political change. For these reasons, it has been difficult for researchers to evaluate the impact of the Stevenson-Wydler Technology Innovation Act of 1980 and The Federal Technology Transfer Act of 1986.

This paper is derived from results of research conducted by the author under the sponsorship of The Engineering Management Department of The George Washington University. This exploratory research was conducted to provide a better understanding of the issues and identify the barriers in government-industry technology transfer. A validated survey questionnaire, designed with the cooperation and assistance of technology transfer professionals in the public and private sectors, was mailed to 531 members of the Technology Transfer Society residing in the United States. Approximately half of the membership represent government and industry and the remainder various professions (academic, legal, consulting, etc.). The response rate exceeded 50%.

Findings indicate thirteen significant impediments to government-industry technology transfer. Included are lack of funds designated for technology transfer activities, ineffective communication, cultural differences, ineffective mechanisms, bureaucratic inertia, not-invented-here syndrome and mission conflicts in government laboratories. Of these

impediments, five were policy-related, two information/marketing-related, and six people/management-related.

The dismal progress in technology transfer from government laboratories to industry is primarily due to the lack of government commitment and industry interest. The government needs to provide leadership to motivate industry interest through creative promotional programs. Industry needs to develop a more positive attitude toward technologies developed elsewhere. The improvement of technology transfer from government laboratories to industry will require technology management expertise, effective leadership and the commitment of government **and** industry executives. Government and industry need to understand each other's environment through improved communication before effective transfer can occur. Government needs to increase educational programs for training technology transfer managers, scientists and engineers in the public and private sectors. The research project concludes that the government has a leadership role in technology transfer and needs to provide the infrastructure for implementation. This paper presents recommendations on improving the government-industry technology transfer process.

INTRODUCTION

> *It is the continuing responsibility of the Federal Government to ensure the full use of the results of the nation's federal investment in research and development. To this end the Federal Government shall strive where appropriate to transfer federally owned or originated technology to state and local governments and to the private sector.*(1)

Uncertainty about increasing global competition and the long term economic well-being of the United States has raised public awareness and government concerns about America's future. Contributing to this uncertainty are rapid technological change and the inability of U.S. companies to quickly transform scientific or technical discoveries into high-quality products and processes for the design and manufacture of these products. Government laboratories are potentially rich source of scientific or technical discoveries. Congress has attempted to address the need for government and industry to cooperate in technology transfer through two pieces of major legislation - The Stevenson-Wydler Technology Innovation Act of 1980 and The Federal Technology Transfer Act of 1986.

The objective was to optimize the expenditure of tax dollars for R&D and regain economic leadership through the transfer of federal technology to organizations that could effectively commercialize it. To date, reports to Congress indicate that the government's efforts to transfer technology from the federal laboratory system to the private sector have achieved far less than was expected.

> *Federal legislation, including the Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986, asked federal agencies to develop detailed and uniform procedures to encourage transfer of technologies to the private sector. Laboratories also were encouraged to develop proactive programs of their own aimed at opening the door to technology-hungry companies. But this subcommittee's inquiries indicated that*

while some laboratories have these programs, they give only lip-service - and little administrative support - to their implementation. Some federal laboratories have not even drafted (technology) transfer plans.(2)

Federal laboratories employ a total of 185,000 (one-sixth of the country's scientists and engineers) and spend about $20 billion dollars annually, yet have produced less than 5% of the 30,000 patents (owned by the federal government) that are licensed for commercial use in the private sector.(3) This dismal record causes critics to question if tax dollars spent on government laboratories should be reduced or redirected if this trend continues. E. Jonathan Soderstrom, director of technology applications for Martin Marietta Energy Systems at Oak Ridge National Laboratory in Tennessee, was quoted as saying:

This statistic is a reflection both of the fact that many government patents have little or no commercial value and that agencies have made little effort to seek private sector users for even their most important commercial inventions.(4)

The lack of significant progress in government-industry technology transfer, according to government reports and recent testimony during Congressional hearings, can be interpreted as a lack of serious commitment by government and lack of interest from industry. The government's lack of commitment can be traced to inconsistent policies within the government (at both the policy making and agency levels) and the lack of management skills in the implementation of technology transfer policy objectives. The lack of interest by the private sector can be traced to the inability of government to effectively promote and market government-developed technologies and the negative perception held by industrial managers of the relevance and/or potential value of technology developed in federal laboratories.

In summary, we have found that the government efforts in this area (implementation of technology transfer policies) have been under-staffed, under-directed and only marginally focused. The result has frustrated government scientists who can't commercialize their inventions, discouraged businesses who can't get at valuable technologies, and penalized taxpayers who have lost untold millions of dollars in unrealized licensing and royalty revenues.(5)

The lack of industry participation in the government's efforts for technology transfer leads to the supposition that **Government-owned technology is one of the external sources *not* adequately explored by businesses.** This research, a project of The George Washington University's Engineering Management Department, was conducted to identify the impediments to technology transfer and provide a better understanding of the issues and barriers in the government-industry technology transfer process.

The author recognizes there have been claims of successes in technology transfer from the public to the private sector. For example, the National Aeronautics and Space Administration (NASA), National Institute of Health (NIH), National Institute of Standards and Technology (NIST), Defense Advanced Research Projects Agency (DARPA) and Department of Defense (DOD) laboratories have publicized technology transfer successes. The degree of effectiveness and efficiency are difficult to determine if success is measured by cost and time expended to achieve the stated objectives. There is a general belief that transfer of government developed R&D in agriculture, health and aeronautics has been successful. These successes required huge amounts of government funding and many, many years of implementation efforts (about 100 years, 70 years, and 50 years respectively).

It should be noted that the business environment is rapidly changing; the technology development life cycle is becoming much shorter and global competition is increasing. American managers are under pressure to be more efficient in translating basic research discoveries to new products and services if their companies are to survive in the 21st century. Those who think there is no need for concern should refer to the U.S. Department of Commerce publication entitled, "Emerging Technologies - A Survey of Technical and Economic Opportunities", Spring 1990. This study indicates that, if current trends continue, the United States could lag behind Japan in most emerging technologies and trail the European Community (EC) in several of them by the year 2000.

SIGNIFICANT FINDINGS

Descriptive statistics were used to analyze the survey responses and determine the distribution characteristics for each questionnaire statement.

Sample Size Characteristics

Government	62	(23%)
Industry	72	(26%)
Other	138	(51%)
Total	272	(100%)

Ninety-three percent of the respondents reported that they are currently (or were previously) engaged in technology transfer activities. Eighty-five percent of the respondents have (or had) decision-making responsibilities in technology management or transfer. The strength of consensus was between the 49% and 95% range; fourteen questions had a consensus of at least 70%; Chi-Square tests indicated no significant

difference in responding to the key issues among government, industry and other professions.

Survey findings indicated that government research quality was not an issue because both industry and government respondents have positive perceptions of government R&D. However, thirteen significant impediments were identified and they represent consensus levels between **seventy and ninety-five percent.** The identified impediments are presented in three categories as follows with the percentage level of respondent consensus indicated in brackets.

(1) Impediments Related to Policy Issues:

* Industry is unwilling to take risks in technology development unless there exists a competitive advantage or it fits into the company's strategic plans (95% agreed)
* Government should not be involved with technology transfer, because it is industry's responsibility to develop it's own technology (94% disagreed)
* Government-developed technologies might be useful but often are not immediately compatible with industry needs (86% agreed)
* The problem is, government laboratories do not focus on commercial R&D because they have different missions (86% agreed)
* Funds designated for technology transfer are inadequate to carry out the government's objective of increasing the flow of technology to industry (76% agreed)

(2) Impediments Related to Information/Marketing Issues:

* Ineffective government-industry communications have impeded efforts to inform industry about federal technologies (81% agreed)

* Government has not been effective in informing industry of its technologies that have potential commercial values (81% agreed)

(3) Impediments Related to People/Management Issues:

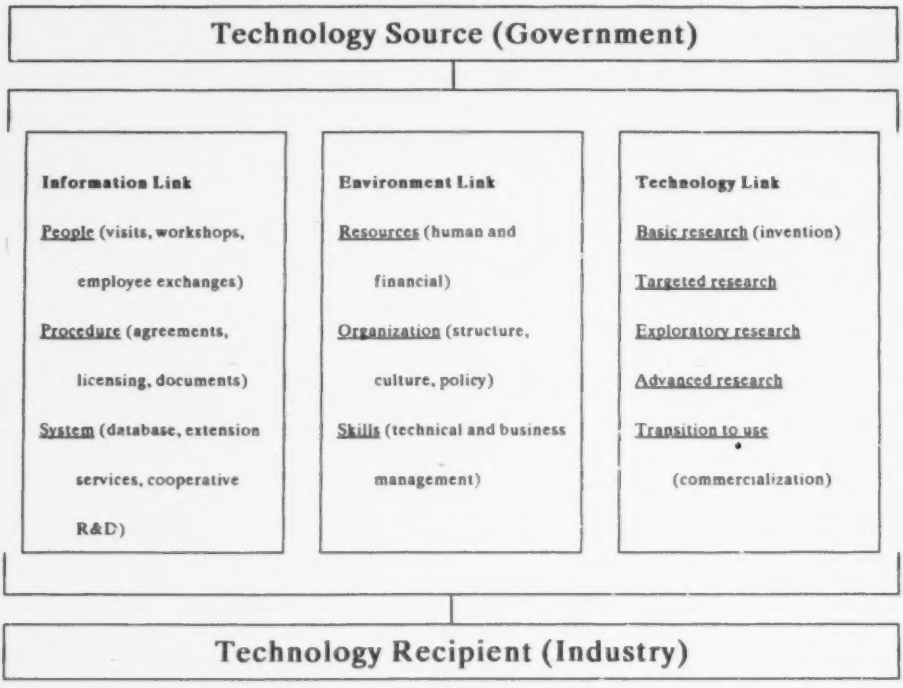
* Government lacks technology management expertise for technology transfer (88% agreed)
* Government bureaucracy is too cumbersome and difficult to deal with (85% agreed)
* Cultural differences between government and industry have negatively influenced their working relationships (80% agreed)
* Industry needs to overcome the "not-invented-here" syndrome mentality (78% agreed)
* Industry lacks technology management expertise for technology transfer (76% agreed)
* The problem isn't primarily due to a lack of government actions, it is also due to the lack of interest and motivation on the part of management (in industry) for federal technology (74% agreed)

Technology Transfer Links (TTL) Model

The Technology Transfer Links (TTL) model was developed by Lee (6) and applied to the analysis of the technology transfer issues identified in this study. The objective was to define management activities in technology transfer and categorize the elements or factors contributing to success or failure of the process. The TTL model shown in Figure 1 is a systems approach that integrates multi-functional capabilities and diverse resources to accomplish a common purpose.

7

Figure 1. Technology Transfer Links Model



There are three inter-related links consisting of an Information Link requiring information management skills; an Environment Link requiring engineering management skills and a Technology Link requiring technology management skills. The three links represent technology transfer elements comprising various activities within the framework of technology management.

CONCLUSIONS

The dismal progress in technology transfer from government laboratories to industry is primarily due to the lack of government commitment and lack of industry interest. The government needs to provide leadership to motivate industry interest through creative promotional programs. Industry needs to develop a more positive attitude

toward technologies developed elsewhere. The improvement of technology transfer from government laboratories to industry will require technology management expertise, effective leadership and the commitment of government **and** industry executives. The government needs to understand industry's needs (e.g., appropriate technology, better incentives, effective and efficient mechanisms) and concerns (e.g., competitor pressures, market and technology development risks). Innovative programs and NEW approaches should be developed to address the following issues:

* Government has a leadership role in technology transfer and needs to provide the infrastructure to improve the implementation process

* Industry technology-based companies need to establish positive environments including appropriate organizational structures for internal and external technology transfer

* Government and industry executives need to collaborate and concentrate on strategic planning and technology management as the new approach to technology transfer and technological innovation

* Government and industry need to understand each other's environment including cultural differences (R&D policy, not-invented-here syndrome, profit motives, etc.) through improved communications before effective technology transfer can occur

* Government needs to increase educational programs for training technology transfer professionals, scientists and engineers in the public and private sectors

> *Government, the national laboratories and industry must make changes if there is to be effective transfer of technology from the government laboratories to industry.*(7)

Interest in improving the technology transfer process is high as shown by the fact that more than 100 business cards were received requesting the

summary of survey results; more than 30 respondents went beyond responding to the survey and sent their comments about various technology transfer issues; and many respondents commented on the timeliness and appropriateness of the research.

The very high level of agreement on the identified impediments (by the majority of respondents) should serve as a catalyst for new thinking and the stimulant for action to overcome the real and perceived technology transfer barriers. Government and industry should develop a long term cooperative strategy and collaborative problem-solving methodology to reduce and overcome the barriers identified. The focus must be on enhancing the implementation process by increasing government-industry interactions, improving communications and reducing cultural barriers.

RECOMMENDATIONS

Regaining U.S. economic leadership and global competitiveness will depend on a variety of factors. These factors include increased government commitment to improve the management of technology in both the public and private sectors; together with the development of consistent policy initiatives to address some of the technology transfer problems identified by this research. The effectiveness of government-industry technology transfer, however, is only one part of the solution to America's declining economic leadership.

> *Technology advancement is a key component in the growth of the United States industrial economy, and a strong industrial base is an essential element of the security of this country.*(8)

The U.S. technology transfer (utilization) agenda, according to official records, is driven by the need to compete in global markets and the efficient use of $20 billion dollars annually committed to

government laboratories. The rapid and effective implementation of technology is the basis for global economic competition and sustaining political leadership. In order to accomplish the stated goals of the federal government - **to increase the flow of technology from U.S. government laboratories to U.S. industry** - it is necessary to develop innovative action plans. These plans should focus on the following six recommendations to overcome the impediments in government-industry technology transfer:

Recommendation #1

The United States government must develop new outreach and marketing programs to convince innovative companies of all sizes that the government laboratory system is a viable source for commercially applicable technology.

Recommendation #2

The government must develop an infrastructure (systems and organizations) for increasing the flow of technology.

> *The nation must coordinate the activities of government, industry and universities to achieve rapid innovation and significantly enhance productivity.*(9)

Recommendation #3

The government must actively promote cooperative research between government and industry laboratories.

> *The success of industry-government lab cooperative R&D will hinge on an understanding of the strengths of particular labs and their unique place in the national system of science and technology providers.*(10)

Recommendation #4

The government must increase incentives for technology development by providing industry with better R&D tax credits,

encouraging cooperative research, and declassifying selective DOD technologies (in view of the rapid political changes in Eastern Europe) to stimulate the technology transfer process.

> *For transfer of technology to work at all levels, inherent barriers must be eliminated and incentives introduced to stimulate the technology transfer process.*(11)

Recommendation #5

The government must develop training and development programs to **ensure reliable and meaningful interaction** between government and industry on a person-to-person basis.

> *If we're successful in linking innovators in our federal laboratories to entrepreneurs in business, they will make the technology transfer process work.*(12)

Recommendation #6

Government and industry laboratory managers must understand the concepts of technology management and apply them in the management of technology development risks. The very important role technology management plays in government-industry technology transfer can not be overestimated.

> *Technology management is an emerging interdisciplinary field developing from industry's competitive needs. As such, business leaders have a problem-driven agenda; they must manage their organizations for the present and manage technology for the future.*(13)

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BIOGRAPHY

Joseph W. Lee, D.Sc., is President of International Consulting Services (ICS). Dr. Lee has corporate and small business management experience plus working experience with government, industry and international companies. He has been an engineering management consultant since 1980 and held engineering and management positions with leading aerospace and high technology companies in the management, development and implementation of technology and engineering systems. Applications include defense and commercial systems in the public and private sectors.

Dr. Lee received his Doctor of Science degree and Masters degree in Engineering Management from The George Washington University. His undergraduate degree is in engineering and mathematics. Dr. Lee also lectures on Engineering and Systems Management at The George Washington University and conducts applied research on engineering and technology management issues.

TESTIMONY OF HAL MCANINCH
PRESIDENT
COMMUNITY COLLEGE ASSOCIATION FOR TECHNOLOGY TRANSFER

HOUSE COMMITTEE ON SMALL BUSINESS
SEPTEMBER 5, 1990

Mr. Chairman, my name is Hal McAninch. I am the President of the College of DuPage, in Glen Ellyn, Illinois. I am also the President of the Community College Association for Technology Transfer (CCATT). Thank you for the opportunity to present this testimony on behalf of the CCATT. CCATT is a coalition of 16 midwestern educational institutions committed to revitalizing the regional economy through technology transfer efforts aimed at small- and medium-sized businesses. CCATT member schools are located in the states of Iowa, Illinois, Michigan and Wisconsin.

As you know, small businesses play a vital role in the U.S. economy by providing jobs to over 45 million people, as well as providing the vast majority of parts and supplies needed by larger manufacturing corporations. Major U.S. manufacturers get 66 percent of the parts used in their products from small- and medium-sized businesses. These supplier firms employ over 10.4 million people nationwide. They produced over 1.3 million new jobs between 1980 and 1986. These firms are the base upon which our nation's manufacturing capacity rests.

Many of these small businesses, however, lag behind the larger U.S. manufacturers and their foreign competitors in productivity and the quality of their products. They are simply not up-to-date in their quality control techniques, such as "just in time " (JIT) delivery of components and statistical process control (SPC), or the use of modern manufacturing technologies and process innovations, such as robotics and programmable automation.

As a result, foreign manufacturers in Germany, Japan and other countries are claiming a growing share of our markets, as major U.S. companies are looking for lower cost/higher quality products in offshore firms with more advanced production technology and expert managerial experience acquired through the use of computerized machinery. If this trend continues, we could find ourselves with state-of-the-art modern facilities in a few leading firms, but with networks of suppliers increasingly located overseas or owned by foreign corporations.

An example of how the lack of modernization in production technologies has affected one sector of our economy should illustrate the potential benefits of technology transfer to small businesses. Industries that specialize in metal-cutting operations comprise approximately 25 percent, or 4 million, of those people employed in manufacturing. As such, one would think that computerized machinery would be widely integrated in these manufacturing plants -- almost a necessity in order to boost productivity and efficiency. According to a nationwide survey conducted in 1987 for the National Science Foundation, however, in over 1,000 plants in the 21 industries comprising the metalworking sector, more than half of these establishments did not have any computerized machines. Furthermore, the survey results indicate that less than 30 percent of the smallest plants (i.e., those with fewer than 20 employees) had purchased even one programmable machine tool.

According to a 1987 National Academy of Science (NAS) report, technological change is an essential component of a dynamic, expanding economy. The modern U.S. economy, in which international trade plays an increasingly important role, must generate and adopt advanced technologies rapidly in both the manufacturing and nonmanufacturing sectors if growth in U.S. employment and wages is to be maintained. Additionally, the

innovation of commercially viable products and processes will also be stunted if the smaller manufacturing firms do not modernize.

Moreover, technology transfer is not just a one-way street connecting the larger company with the smaller supplier firm. After learning how to integrate these new technologies into their plants, these smaller supplier firms will begin to develop the capacity to respond rapidly, with high quality parts, to the specific needs of their larger customer firms. In these partnerships, learning flows both ways; hence, technical stagnation of the small manufacturing sector could cause an overall loss of innovative capacity in manufacturing -- not just jobs -- and a further weakening of the U.S. competitive position in the global marketplace.

Mr. Chairman, H.R. 4659, the National Technology Extension Service Act of 1990, which will create a national Technology Access Program, will fill an important need among small businesses -- particularly those in rural areas -- that previously have been deterred from taking advantage of the resources available at Federal laboratories and universities. The program will replicate the highly successful agricultural extension system by facilitating the transfer of emerging technologies and the dissemination of technical data to small businesses through a network of experts.

By making information about technological breakthroughs and resources developed at Federal laboratories and federally-supported institutions accessible to small businesses simply through the use of a personal computer, this program will remove many of the bureaucratic barriers that small businesses have faced in their efforts to improve employee productivity and product quality. Moreover, by explicitly including a provision that will create a telephone line for businesses to use to contact technical experts in Federal

laboratories, unanswered calls resulting in lost opportunities and costly delays can become a phenomenon of the past.

H.R. 4659 also includes a provision to allocate grants to Small Business Development Centers (SBDCs) to assist them in increasing the accessibility of the data base for businesses through training and demonstrations. I think this provision will be very helpful. I have an SBDC on my campus at the College of DuPage and several other CCATT members also have SBDCs at their schools. Additional financial support would supplement our SBDC's current activities and expedite the transfer of new technologies to small businesses. For example, one of the small, new companies in our area, Precision Connecting Rod (PCR), builds connecting rods for large suppliers such as Bendix who installs them into air conditioning units for Ford Motor Company. Recently Ford demanded that all of their suppliers install Statistical Process Control (SPC) into their operations or else lose their status of being a supplier. The College of Dupage assisted PCR in purchasing a computer system, developing the software program, and training some of their staff to perform the necessary functions that helped save the area 50 jobs.

Mr. Chairman, H.R. 4659 is an excellent bill that is designed to benefit small businesses in several ways by facilitating their access to new, technological innovations in a cost-effective and time-efficient manner. On behalf of the Community College Association for Technology Transfer, I wholeheartedly support it and the proposed Technology Access Program embodied in this legislation.

At the same time, I would like to offer a proposal which I think will strengthen H.R. 4659 and add to the positive impact it would have on small businesses. My suggestion is simply to provide for another dimension of technology transfer vitally needed by most

small businesses -- the need for technical assistance and training in actually implementing new technologies into the small business shop, plant, or office.

To illustrate this need, let me describe a situation that many owners and managers of small enterprises might have to deal with in the everyday real world of business. Let's suppose that a small business person finds out about the national technology data base and succeeds in accessing the data base through a personal computer. After identifying a few different types of advanced technologies which might improve business productivity, this person calls up a technical expert at the Argonne National Laboratory who recommends the use of a Computer-Assisted Manufacturing (CAM) system to upgrade the efficiency of the business' manufacturing plants. While the recommendation is very valuable, the small business person is not sure how to actually implement such a system, including what type of specific computers to purchase or who to call to train the employees to use the new technology. At this point, it is likely that the decision to invest in the new technology is no longer dependent on getting expert advice, but rather requires more direct, "hand-on" technical assistance and training.

That's when a community college and the CCATT would come into the picture. Community colleges in the CCATT serve their local communities by responding to the complex and changing needs of small businesses and industry -- through training and educational programs for skilled workers or technical assistance programs for managers. The 16 community colleges in the CCATT, located in four midwestern states, are committed to sharing the expertise and resources they have in the area of technology with each other and with small and medium-sized business supplier firms in the region. We have designed our consortium to complement the activities of the SBDCs by, for example,

working with them to create an outreach program to ensure that any available technology access program is well-publicized to small businesses. Furthermore, our institutions can provide a delivery vehicle for the application phase of technology transfer activities.

CCATT's synergistic approach has several benefits. For example, while some CCATT member schools can provide regional demonstration labs for "hands on" testing of new manufacturing equipment, other institutions specialize in developing on-site and off-site technology development programs for managers or technology training programs for skilled workers. In addition, through its own network of contacts with small businesses, community colleges can identify those in need of the technology data base service proposed to be established by H.R. 4659, thereby increasing the number of businesses served.

CCATT could also augment the SBDCs' role in supporting small businesses by serving as a technology implementation system, i.e. demonstrating how new technologies can be integrated into existing plants in a cost-effective manner. To assist supplier firms in objectively evaluating and fully understanding how advanced innovations and processes can improve productivity and enhance performance, selected CCATT institutions would provide specialized training programs, to be implemented either on-site or off-site, designed to meet the needs of individual businesses, as well as educational programs, delivered in either classrooms or through audio/video telecommunications systems.

Mr. Chairman, on behalf of the Community College Association for Technology Transfer, I compliment you and the other co-sponsors of H.R. 4659 for proposing this innovative legislative proposal. At the same time, I request that the Committee consider expanding the bill to include an authorization for a demonstration project allowing CCATT to provide small businesses in our region with education, training, and technical assistance

with respect to technology transfer and application. These activities would be fully coordinated with the SBDCs in the region, especially those affiliated with each of the CCATT member institutions. I am attaching a copy of S.2897, a bill introduced by Senator Levin, Chairman of the Senate Small Business Subcommittee on Innovation, Technology and Productivity, and co-sponsored by Senators Kohl, Harkin, Grassley, Simon, and Kasten, which could be considered as an amendment to H.R. 4659 authorizing the proposed CCATT demonstration project. In addition, I am also attaching a brief summary of the proposed CCATT demonstration project and a list of the CCATT members. I would, of course, be pleased to provide any further information about CCATT that the Committee might need in considering this request.

In conclusion, I strongly believe that the Technology Access Program authorized by H.R. 4659, in combination with the demonstration project proposed by CCATT and in conjunction with the various SBDCs in our states, can be a very potent resource for small businesses in their efforts to implement new technologies into the American workplace. This kind of unique partnership involving the public and private sectors, community colleges, SBDCs, and the federal government is a model that can lead the way towards a renewed strength for our Nation's small manufacturing industries and help to regain the competitiveness edge American businesses need in the world today.

COMMUNITY COLLEGE ASSOCIATION
FOR TECHNOLOGY TRANSFER
Member Colleges

College of DuPage
Glen Ellyn, Illinois

College of Lake County
Grayslake, Illinois

Illinois Central College
East Peoria, Illinois

Joliet Junior College
Joliet, Illinois

Lewis and Clark Community College
Godfrey, Illinois

Moraine Valley Community College
Palos Hills, Illinois

Triton College
River Grove, Illinois

Eastern Iowa Area Community College
Davenport, Iowa

North Iowa Area Community College
Mason City, Iowa

Grand Rapids Junior College
Grand Rapids, Michigan

Jackson Community College
Jackson, Michigan

Gateway Technical College
Kenosha, Wisconsin

Milwaukee Area Technical College
Milwaukee, Wisconsin

Northcentral Technical College
Wausau, Wisconsin

Western Wisconsin Technical College
LaCrosse, Wisconsin

I. EXECUTIVE SUMMARY

The Community College Association for Technology Transfer (CCATT) is a coalition of 16 midwestern educational institutions committed to revitalizing the regional economy and modernizing its manufacturing base through a unique, cooperative effort among business, industry, and government.

By promoting and assisting industry to implement technological innovations, CCATT and its members are addressing some of the most serious problems and important challenges facing America's manufacturing sector. We not only offer a wide variety of worker education and training programs, but also provide small and medium-sized businesses with an opportunity to keep up with rapidly changing technology and higher product quality standards. This will enable them to maintain a competitive edge as they move toward the 21st Century.

The Need to Revitalize America's Manufacturing Base

In the decade following World War II, American industry supplied the world with the highest quality, most efficiently produced manufactured goods and American workers' productivity was 60 to 85% higher than any of our major competitors. Today, our manufactured products as well as our productivity levels have fallen behind or are being overtaken by Japan, West Germany and the newly industrialized Pacific Rim countries. These trends must be reversed if there is to be any chance for growth and prosperity in our manufacturing base, a reduction in our huge trade deficit, and a solution to our growing workforce problems.

The Vital Role of Small Business Suppliers

Major U.S. manufacturers get 66% of the parts used in their products from small and medium-sized businesses. These supplier firms employ over 10.4 million people nationwide and produced over 1.3 million new jobs between 1980 and 1986. These firms are the base upon which our manufacturing capacity rests, but they lag behind the larger U.S. manufacturers and their foreign competitors in productivity, quality control, and the use of modern technologies and innovative organizational methods. As a result, foreign manufacturers are claiming an ever greater share of our markets and U.S. manufacturers are looking for lower cost/higher quality products from off-shore sources.

Introducing New Technologies into the Workplace

While America excels in the development of software and process engineering, it takes capital and training to introduce these technologies into the workplace so that they actually provide a competitive advantage to U.S. companies. Most small and medium-sized supplier firms do not have the money or the technical expertise to cost-effectively bring technological innovations, such as robotics, laser applications, new manufacturing processes, and quality assurance programs into their workplaces. That

leaves too many of our manufacturing suppliers uncompetitive in the international marketplace and unable to meet the minimum qualifications for government or major corporate contracts. Expanding the capacity of small and medium-sized supplier firms to use new technologies will assist them in not only meeting the "threshold" standards of quality required to compete successfully for profitable business opportunities but also regaining the worldwide lead in manufacturing technology.

The Role of CCATT

CCATT and its network of educational institutions are committed to sharing the expertise and resources they have in the area of technology with each other and with small and medium-sized firms. They have extensive experience in developing applied technology training courses such as Computer Aided Design (CAD), Computer Integrated Processes (CIP), and Statistical Process Control (SPC), as well as workplace literacy programs. In addition, some CCATT member schools have established regional demonstration labs that provide "hands-on" testing of new manufacturing equipment so that supplier firms can determine whether or not to invest in it. Such evaluations of new technologies, processes, and training programs will be provided objectively -- in contrast to information provided to businesses by equipment salesmen.

While community colleges across the country have developed expertise in specific technological programs for specific industry needs, no one institution can provide all of the answers. CCATT offers a way to link a variety of resources that will provide the best response to the needs of local industries. For example, CCATT member institutions will maintain a database of existing and emerging technologies and make that information available to local businesses. In addition, CCATT plans to provide high quality technical assistance and training programs and to conduct workshops and seminars for workers and key supervisory and management personnel.

The Need for a Federal Investment in the CCATT Program

In order to expand the ability of CCATT members to contribute to the revitalization of our manufacturing base, we are seeking the support of the Congress in the form of a multi-year authorization and appropriations. Such support will build upon the considerable amount of local, state and private funding invested in our efforts to date.

We are seeking federal assistance at this time because we believe that the CCATT is a model partnership among education, business, industry, and government that can prove to be a major breakthrough for economic growth and modernization in the manufacturing regions of the Nation.

101ST CONGRESS
2D SESSION

S. 2897

To establish a small business technology transfer demonstration program with the Community College Association for Technology Transfer (or other appropriate organization), and for other purposes.

IN THE SENATE OF THE UNITED STATES

JULY 24 (legislative day, JULY 10), 1990

Mr. LEVIN for himself, Mr. KOHL, Mr. HARKIN, Mr. GRASSLEY, Mr. SIMON, and Mr. KASTEN) introduced the following bill; which was read twice and referred to the Committee on Small Business

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A BILL

To establish a small business technology transfer demonstration program with the Community College Association for Technology Transfer (or other appropriate organization), and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. CONGRESSIONAL FINDINGS.

The Congress finds that—

(1) The Small Business Administration has a mission to promote the transfer of technology to small businesses.

(2) Small businesses, which supply at least two-thirds of the parts used by major manufacturing companies in the United States, play a crucial role in the national economy.

(3) Encouragement and maintenance of technologically advanced small manufacturers is essential to the Nation's economic well-being and security, and to giving the Nation a strong competitive position in the world.

(4) The efficient and effective use of advanced manufacturing technology by small businesses can increase productivity by as much as 60 percent.

(5) In order to successfully introduce and utilize advanced technology in the workplace, small businesses require available and affordable education, training, and technical assistance for their workers and managers.

(6) Community and technical colleges can provide the critical education, training, and technical assistance in technology transfer for commercialization and application needed by small businesses to be more productive and to compete more effectively.

(7) The Federal Government can stimulate and assist in the development of small business technology modernization efforts by supporting innovative coalitions of community and technical colleges which extend

across State boundaries and involve a regional network in partnership with business and industry.

(8) The Community College Association for Technology Transfer (hereafter in this Act referred to as "CCATT"), is a coalition currently composed of 16 community and technical colleges.

(9) CCATT is committed to revitalizing the regional economy and has proposed a unique cooperative demonstration program involving industry, business, and government in a regional approach to technology transfer and application for small businesses.

SEC. 2. SMALL BUSINESS TECHNOLOGY TRANSFER DEMONSTRATION PROGRAM.

(a) ESTABLISHMENT.—There is established a Small Business Technology Transfer Demonstration Program (hereafter in this Act referred to as "Program") to be administered by the Administrator of the Small Business Administration (hereafter in this Act referred to as "Administrator"). To carry out the purpose of such Program, the Administrator is requested to enter into a contract with CCATT (or, if such organization is not available, another organization with appropriate qualifications).

(b) PURPOSE OF PROGRAM.—The purpose of the Program is to provide small businesses with education, training, and technical assistance with respect to technology transfer

and application through CCATT (or other appropriate organization).

(c) ACTIVITIES.—The CCATT (or other appropriate organization) shall develop a regional demonstration program. Each participating community college will provide small businesses in its area with training and assistance with respect to—

(1) technological innovations,

(2) statistical process control,

(3) computer-assisted design,

(4) computer-assisted manufacturing and computer-integrated manufacturing,

(5) implementation and deployment of telecommunications and other interactive systems, and

(6) other new equipment and advanced manufacturing processes.

SEC. 3. USE OF SMALL BUSINESS DEVELOPMENT CENTERS AND OTHER RESOURCES.

The Administrator shall use to the maximum extent feasible the Small Business Development Centers and other available resources to facilitate CCATT (or other appropriate organization) in carrying out the purposes of this Act.

SEC. 4. GUIDELINES.

The Administrator shall, after consultation with CCATT (or other appropriate organization), develop guide-

lines for allocation of funds to members of CCATT (or other appropriate organization). Allocation of funds shall be based on a merit review process, including consideration of a demonstrated commitment and ability to conduct the types of activities described in section 2(c).

SEC. 5. REPORT TO CONGRESS.

Not later than June 30, 1993, the Administrator shall report to the Committees on Small Business of the Senate and the House of Representatives on the results of the demonstration Program and shall make recommendations regarding extension and expansion of this Program to other regions in the country.

SEC. 6. AUTHORIZATION.

There are authorized to be appropriated to the Small Business Administration $20,000,000 for fiscal years 1991 and 1992 to carry out the demonstration Program established by this Act.

John W. Orf, Ph.D.
Vice President
Research & Development

September 18, 1990

John J. LaFalce, New York
Chairman
Congress of the United States
House of Representatives, 101st Congress
Committee on Small Business
2361 Rayborn House Office Building
Washington, D.C. 20515

RE: H.R. 4659, a bill to create a Technology Access Program

Dear Congressman LaFalce:

I am personally very pleased that the Committee on Small Business has asked for my testimony on the Technology Access Program described in bill, H.R. 4659.

The timing of this proposed bill is even more apparent as we approach the 21st century, which clearly will prove the need for rapid access to technology in order for businesses in the United States to remain competitive in a world marketplace. Certainly, technology advancements have left a tremendous manufacturing impact on the steel, automotive and electronics industries. Being trained as a research scientist, and now working in industry, I know there is a vast wealth of information and expertise available in federal laboratories and in universities. American industries (particularly small businesses) seem unable to efficiently and effectively tap this resource. The spirit and intention of H.R. 4659 would go a long way toward improving and facilitating rapid access to technology by small businesses.

As part of my discussion, I will now present a brief description of my personal experience with technology access.

> I am Vice President of Research and Development at INCSTAR Corporation located in Stillwater, Minnesota. INCSTAR is an international leader in the research and development of specialty immunoassays used by major hospitals, clinical reference laboratories and medical researchers. Sales are expected to hit about 27 million dollars this year. INCSTAR employs 240 people, 27 of whom are in R & D. The nature of our business dictates that my R & D people have easy, rapid access to state-of-the-art, forefront technology.

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When I first joined INCSTAR in 1979, sales were approximately 1 million dollars with four people involved with R & D. Being small at that time, and with limited funds, I found myself frequently frustrated and hindered in attempts to gain access to technology and information. The University of Minnesota Medical Library thirty miles away was the closest available information resource. Finally, in 1982, my boss realized the need for and benefits of rapid easy access to technology information. With his approval, I proceeded to learn how to use an on-line computer database system called Dialog. Dialog was a quantum leap in the right direction, although efficiency with the system remained problematic. In 1987, our company was introduced to a new information service available from a company called Teltech. Exhibit 1 is a copy of what Teltech believes that they have to offer. Although their data is meant as an example, I agree with them in principal.

INCSTAR currently spends approximately $17,000 per year for Teltech's service. We log about 120 interactive information searches during the year equating to around $140 per interaction. Our R & D budget is 2.7 million dollars and Teltech's information access service amounts to 0.6% of our budget. Management believes this small part of our R & D investment provides an invaluable resource to help us maintain a competitive advantage.

The main strength of a technology information access service should be the speed at which solutions to problems can be addressed and the quality of answers obtained. A professional information service, described in H.R. 4659, would aid key personnel in small businesses by helping them obtain solutions rapidly without the added pressure and time to search on their own. Small businesses tend to live and survive on their ability to solve highly technical problems in the shortest time possible. This allows them to hit the market rapidly with new products and, in many cases, before anyone else.

Typically, small, start-up businesses tend to stretch and maximize the use of their R & D dollars. Therefore, the use of an information access service would appear, on the surface, hard for them to justify. A bill such as H.R. 4659 would go a long way towards providing a critical asset to many small businesses that could undoubtedly play a role in success versus failure.

Section 2 of H.R. 4659 allows any existing Small Business Development Center to apply for inclusion in the Technology Access Program. This seems very logical and common sense would lead one to visualize the important added impact such a program would have on those small businesses already involved in research funded by the Small Business Administration.

As you may already know, the State of Minnesota has made a commitment to a similar Technology Access Program as outlined in H.R. 4659. I have presented testimony on two occasions in 1989 to Minnesota legislative committees and I have followed the progress of the state's commitment. Candace Campbell is President of Minnesota Project Outreach (MPO). MPO is the functional outcome of legislation in Minnesota to develop a small business technology information access program. Exhibit 2 briefly describes MPO and I would encourage you to contact Ms. Campbell for ideas that may provide insight as the Federal Government attempts to set up a similar program.

Sincerely,

John W. Orf

JWO:sle

Enclosures

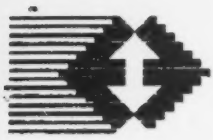
Exhibit 1

In many cases, you and your competitors are trying to find the same critical answers. With Teltech, you'll arrive first.

If you supervise engineers, you know the day-to-day challenge of helping your people be as good as they can be. Teltech builds the effectiveness of your staff by accelerating the speed at which they are able to locate and retrieve needed information — especially outside their own area of expertise. And the economies of such improvement can be dramatic.

For example, a staff of 20 technical professionals represents an annualized average of $1,200,000 in salaries and benefits. Since about one third of their time is spent gathering technical information, such activity amounts to a yearly investment of $400,000. Teltech will increase their information gathering efficiency by 25%, translating into a cost savings of $100,000. Looking at it another way, the approximate 3,462 hours this group will "gain" each year can be spent doing what's most important . . . putting the information to work.

In short, Teltech helps you get the most out of your human resource investment. It equips your people to arrive first at the critical answers both you and your competitors are seeking. And it turns their information gathering and application capabilities into a powerful strategic force.



MINNESOTA
PROJECT
OUTREACH
CORPORATION

University Technology Center
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Minneapolis, Minnesota 55414
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MINNESOTA PROJECT OUTREACH

Minnesota Project Outreach represents the Minnesota legislature's commitment to maintaining the competitiveness of small and medium sized businesses in Minnesota by making "state-of-the-art" expertise and information readily available and easily accessible. Approved in 1989, its purpose is:

- To facilitate the transfer of technology and scientific advice from the University of Minnesota and other institutions to businesses in the state that may make economic use of the information, and
- to assist small and medium-sized businesses in finding technical and financial assistance providers that meet their needs.

These services are being made available on a subscription basis through Minnesota Project Outreach Corporation and its sponsors: the University of Minnesota, the Minnesota Department of Trade and Economic Development and the Greater Minnesota Corporation. The services available immediately through Minnesota Project Outreach currently include:

Science and Technology Expert Network -- a network of over 5,000 experts in science and technology fields, willing and capable to provide answers to technical problems through direct telephone contact.

Literature Searching and Document Delivery -- working with experienced, technically-savvy information specialists, users can electronically search hundreds of business and technical databases.

Technical Help Staff -- Minnesota Project Outreach is committed to solutions. Through qualified MPO staff each company's technical problem is narrowed and the appropriate expert or information source is tapped. And every interaction through the MPO system is followed up, to make sure the user gets what it called for -- a solution.

Within the next year, Minnesota Project Outreach will offer its subscribers the following new databases and services:

Business Assistance Information and Referral -- a database of public and non-profit technical and financial assistance providers and programs sponsored by federal agencies, state agencies, educational institutions, chambers of commerce, civic organizations, community development groups, local government, and private industry associations with an on-line interview system and a toll-free helpline designed to match business information needs with business assistance providers.

U of M Licensable Technology Database -- a database containing descriptive and technical information on hundreds of technologies, patents and/or inventions available for licensing from the University of Minnesota.

U of M Technical Research Projects -- a database containing a description of thousands of ongoing technical research projects of the University of Minnesota and their possible market applications and other commercial potential.

U of M Technical and Business Education -- a database containing the technical and business education opportunities including programs, workshops and seminars.

Greater Minnesota Corporation Services and Programs -- a database containing information about GMC-sponsored programs, i.e. business innovation centers, applied research institutes, advanced manufacturing technology centers, research grants and venture capital programs.

Minnesota Project Outreach's charter subscribers will include up to 75 public access sites and 400 small and medium sized Minnesota companies.

Linking Minnesota Business with Technology, Technical Experts and Business Assistance